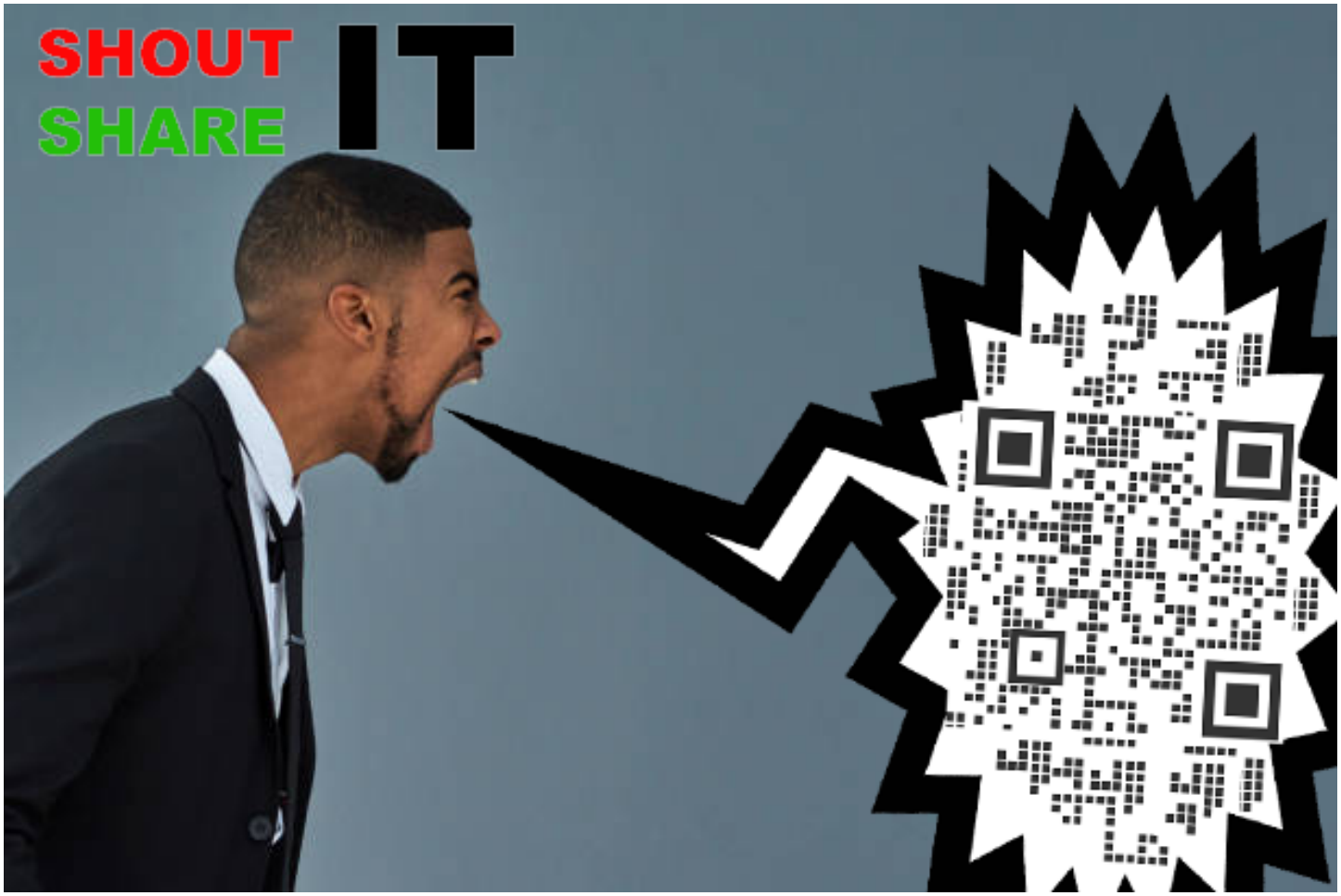
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ECONOMIC STUDY OF NEW HAMPSHIRE POULTRY FARMS

By H. C. WOODWORTH and F. D. REED

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, N. H.

TABLE OF CONTENTS

Page

THE STUDY—Introduction 3
Farms Selected—Type and Size 4
THE FINANCIAL SIDE—Investment 5
Depreciation Charges 7
Receipts 7
Expenses 8
Monthly Relationship of Receipts and Expenses 9
Financial Returns 12
GENERAL DESCRIPTION OF MANAGEMENT—Breeding Stock 13
Management of Layers and Breeders 13
Brooding and Rearing 14
LABOR—Division of Time 15, 16
Comparison of Labor on Laying Flocks 17
Comparison of Labor in Rearing Pullets 18
Labor Efficiency 19
Hired Labor 20
FEED CONSUMPTION OF LAYERS—Pullet Layers 21
Old Hens 22
Weekly Feed Consumption per Dozen Eggs 23
MORTALITY AND CULLING—Mortality 24
Culling 25
Rate of Decrease in Population of Laying Flock 26
Per Cent of Housing Capacity for the Year 27
EGG PRODUCTION—Annual Egg Production 28
Egg Production by Weeks 29
Seasonal Production on Individual Farms 30
EGG SIZE—Egg Size Distribution by Age of Pullets 33
Distribution of Eggs into Grades by Age of Pullets 34
Effect of Dates of Hatch on Distribution of Eggs into Grades 35
Difference in Egg Size Between Flocks 36
THE PROBLEM OF DATE HATCH—Production Curves on Three Dates of Hatch 36, 37
The Effect of Date of Hatch on Value of Total Yearly Product 39
Evening Up Production 39
Efficiency in Use of Equipment 40
THE COST OF PRODUCING MARKET EGGS—Eggs a Joint Product 40
A Formula 40
Use of Formula in Outlook Work 41
Relative Comparison of Cost of Producing Eggs 44
Feed Cost 45
Labor Cost 46
Depreciation of Stock 47
Use of Buildings 47
Old Hens for Market Eggs 47
COST OF PRODUCING HATCHING EGGS—Producing Hatching Eggs for Replacements 48, 49
INCUBATION RECORDS AND COSTS—Cost of Incubation 50
Cost of Producing Day-Old Chicks 51
GROWING PULLETS—Detail Records on Cost of Growing Pullets on 18 Farms 52, 53
Use of Formula in Outlook Work 54
Detail Cost of Producing Pullets (Heavy Breeds) 55
Detail Cost of Producing Leghorn Pullets 57
Further Studies Needed 57
SUMMARY 58

Economic Study of New Hampshire Poultry Farms*

H. C. WOODWORTH and F. D. REED

Commercial poultry raising has been expanding in southern New Hampshire for a decade or more. In this period many small dairy farms have gradually been converted into poultry establishments, and the individual poultry farm has tended to become larger in size as measured by hens housed. This development of the highly specialized commercial poultry farm has been stimulated by a period of very favorable conditions.

In the first place, the New England egg markets, especially during fall and winter, have taken large quantities of fresh hennery eggs at a considerable premium above mid-west eggs. Also, grain prices since the war have been low, giving the poultryman a favorable feed-egg price ratio. In addition, a large group of poultrymen developed special poultry skill and technique, which enabled them to turn the low-priced grain into premium eggs with a margin that encouraged the expansion of the industry. The development of disease-free flocks and the production of eggs in early fall and winter by use of early hatched pullets have been of no small significance.

According to the 1930 census, the value of poultry meat and eggs produced in New Hampshire for the preceding year was $6,464,481,—practically double the figure in 1920. While the industry as a whole has sailed along without mishap and with good margins for a considerable period, it was believed that a detailed economic study was needed as a guide to the future.

Consequently, a study was undertaken in the fall of 1929 to secure details of management and costs on twenty-three commercial poultry farms. For a period of one year beginning with August and September, 1929, weekly or bi-monthly visits were made to each farm to collect and check information, and to observe the individual management problems. The co-operating poultrymen kept financial records of expenses and receipts, weekly egg production, brooding and incubation records.

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*Acknowledgment is made to the staff of the Poultry Department, especially to T. B. Charles, for assistance in the study.

Acknowledgment is also due to the following poultry farm operators for their patience in keeping records and for their co-operation in studying poultry problems:

George Blodgett
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Henry Willgeroth
Irving Wilson

The field man was able to secure data on egg size by weighing samples of 100 eggs at weekly visits. Much of the other material gathered and analyzed could not have been secured without these frequent visits.

Farms Selected

Farms were selected in Rockingham, Strafford and Hillsborough Counties on the basis of type, size, the convenience with which the farm fitted into a route and the willingness of the individual to co-operate. Very few commercial poultry farms in New Hampshire are diversified to the extent of combining poultry with such other enterprises as apple orcharding or dairying; and consequently, the diversified type could not be included in the study. Thus, all the farms selected were of a highly specialized commercial poultry type. Fifteen had some diversification within the poultry business itself through the production of hatching eggs, day-old chicks or breeding stock. Eight specialized in market eggs.

The number of birds (Table 1) housed in the fall of 1929 ranged from 513 to 3,099 with an average of 1,290. Eight farms had less than 1,000 layers, and three had over 2,000. The average number of layers for the year (a figure obtained by dividing total hen days for the year by 365) was 995.

Table 1—*Size of flock on 23 commercial poultry farms studied*

Farm No.	Total hen days for year	Number average birds for year	Maximum number of birds
1	361,659	991	1,273
2	171,990	471	610
3	238,820	654	1,004
4	929,962	2,548	3,099
5	379,630	1,040	1,307
6	129,329	354	513
7	254,448	697	995
8	246,901	676	761
9	554,328	1,519	1,936
10	352,832	967	1,341
11	589,257	1,614	2,126
12	768,263	2,105	2,727
13	305,011	836	1,060
14	180,677	495	751
15	256,913	704	1,057
16	167,073	458	613
17	212,899	583	862
18	407,816	1,117	1,314
19	250,782	687	1,000
20	404,140	1,107	1,350
21	176,557	484	575
22	495,056	1,356	1,731
23	522,883	1,433	1,673
Total	8,357,226		29,678
Average all	363,358	995	1,290

With the exception of two young men under 30 who had been in business only three years, the operators had become well established. The average length of experience in commercial poultry keeping of the twenty-three men was 11 years. One man had kept poultry on a commercial scale for 33 years. The operators ranged in age from 27 to 76 years with an average of 43. Four men were under 30, and three were over 60.

While the farms do not represent a random sample, it is thought that in general the study of the individual farms and the analysis of the group as a whole show a fairly accurate picture of the commercial poultry industry of the state.

On many farms old dairy barns have been remodeled into poultry houses with three to four decks

THE FINANCIAL SIDE

Investment

The average investment of the 23 farms was $13,424, or $10.40 per layer, based on the number of layers housed in the fall of 1929. (See Table 2.) Of this investment, real estate including land and buildings represented about 55%, poultry stock 29%, equipment 13% and supplies 2%.

The smallest individual investment was $6,034, and the largest was practically six times as much, or $36,707. Approximately 44% of the real estate value was in special poultry buildings.

When the farms were grouped according to size of flocks as in Table 3, the inventory per bird was over $19 in flocks below 800; $13 for

TABLE 2—*Average capital investment per farm for 23 farms*

	At beginning of year		At end of year*		Average inventory		Average inventory per bird	Per cent of total inventory	Inventory gain	Inventory loss
	No.	Value.	No.	Value.	No.	Value				
Real estate, acres of land.	82.3A	$1631.48	82.3	$1631.48	82.3	$1631.48	$1.26	12.15	.....	.....
Dwelling house	.....	2052.13	.....	2052.13	.....	2052.13	1.59	15.29	.....	.....
Poultry buildings	.....	3290.09	.....	3278.53	.....	3284.31	2.55	24.46	.....	$11.56
Other buildings	.....	460.87	.....	469.67	.....	465.27	.36	3.47	$8.80	.....
Total real estate.....	.....	7434.57	.....	7431.81	.....	7433.19	5.76	55.37	.....	2.76
Equipment, Poultry	.....	1296.28	.....	1346.94	.....	1321.61	1.02	9.84	50.66	.....
Equipment, Other	.....	372.46	.....	352.69	.....	362.58	.28	2.70	.....	19.77
Supplies & Feed (Poultry)	.....	175.40	.....	152.00	.....	163.70	.13	1.22	.....	23.40
Supplies & Feed (Other)..	.....	127.42	.....	116.73	.....	122.08	.09	.91	.....	10.69
Hens	472.8	668.55	624.1	721.16	548.45	694.86	.54	5.18	52.60	.....
Pullets	1328.2	2592.41	1555.3	2956.68	1441.75	2774.54	2.15	20.67	364.27	.....
Cockerels	180.2	278.48	144.7	285.56	162.75	282.02	.22	2.10	7.08	.....
Cocks	3.7	8.13	2.2	5.35	2.95	6.74	.....	.05	.....	2.78
Miscellaneous poultry	137.4	82.28	123.4	106.03	130.4	94.16	.07	.70	23.75	.....
Value other stock.....	.....	161.30	.....	175.87	.....	168.58	.13	1.26	14.57	.....
Total capital	.....	$13197.29	.....	$13650.82	.....	$13424.06	$10.40	100%	$453.53	.....

* *Inventory figures for end of year* allow for a 10% depreciation charge on the poultry buildings and equipment. Average inventory per bird is based on number of birds housed in fall.

flocks between 800 and 1000; approximately $10 for flocks between 1000 and 1400; $8 for flocks of 1600 to 1800; and $10 for flocks above 1800 layers. As the size of flocks increased, total investment increased but the investment per bird tended to decrease.

Table 3—*Capital investment and size of flock*

Size of flock	Number of farms	Average inventory	Inventory per bird
500 — 800	6	$7,432.66	$19.44
801 — 1000	3	12,563.43	13.19
1001 — 1200	3	11,182.90	10.75
1201 — 1400	5	13,432.91	10.20
1401 — 1600	..	.....	.....
1601 — 1800	2	13,592.48	7.99
1801 — over	4	24,642.76	9.97
Average for all	23	$13,424.06	$10.40

Depreciation Charges

Depreciation on special poultry equipment and buildings was assumed to be 10%. This was set fairly high in order to put earnings on a more conservative basis. Commercial poultry farming has become a factory proposition in which large amounts of purchased feed are converted into a product that has enjoyed a special premium. Yet disease and lack of production due to causes beyond the control of the individual have in certain instances turned the profits of apparently skilled and experienced operators to heavy losses. Moreover, new methods and better equipment are constantly making other equipment obsolete. An individual may find it difficult to dispose of his holdings, if for any reason he is forced to give up the business. Under these conditions the operator should hesitate to invest in fixed capital unless the principal can be drawn out within ten years. In the case of the producer who remains in business and is successful over a period of years, 10% depreciation is probably higher than the actual. In the case of the producer who is forced to quit or is not very successful, it may be too low. The successful man with large income will not object to a 10% depreciation charge; the beginner will do well to make estimates on at least this basis. As shown in Table 4, the depreciation of special poultry buildings averaged $365 per farm, and depreciation of equipment averaged $204—a total of $569 for buildings and equipment.

Receipts

The average farm cash receipts were $9,636 (Table 5). When including the increase in inventory of $453, the total receipts averaged $10,089. This is a gross income of $7.82 per bird housed, or $10.13 per bird when based on the average number of laying birds through the year.

It is well to note that only 44% of the gross income was from sale of market eggs and 11% from hatching eggs. The remaining 45% was made up of several items, including live and dressed fowl 11%, broilers 11%, day-old chicks 6.7%. In a group of five farms which specialized

Table 4—*Depreciation charges* — average of 23 farms*

Real Estate		
Poultry laying houses	$235.50	
Barn used for poultry	25.51	
Permanent brooder houses	32.35	
Other poultry buildings	72.01	
Total depreciation real estate		$365.37
Equipment		
Batteries	$4.24	
Colony houses	40.17	
Shelters	17.84	
Incubators	47.87	
Brooder stoves	15.18	
Hoppers	7.99	
Fountains	3.36	
Egg cases	1.96	
Shipping coops	.90	
Miscellaneous poultry equipment	15.34	
General equipment		
Car or truck†	39.85	
General farm machinery	5.85	
Miscellaneous	3.07	
Total depreciation equipment		$203.62
Grand total depreciation — real estate plus equipment		$568.99

* Depreciation charged at 10% on poultry, real estate and equipment. No depreciation charged on other real estate including dwelling house. Money spent for minor repairs does not entitle item of real estate or equipment to any deduction in depreciation charge.

† Where car or truck was used largely for business, depreciation was charged.

in market eggs, 51.4% of the total receipts were from sale of market eggs, 18% from sale of broilers and roasters, and 12.5% from sale of fowl. On the other hand, in a group of five farms which specialized in breeding, the receipts from sale of market eggs were 37.8%, hatching eggs 17.9%, day-old chicks 14.8%, broilers and roasters 10.9% and fowl 10.6%.

Expenses

The average cash expense on the 23 farms was $8019 (Table 6). This is $6.20 per bird housed, or $8.05 per bird based on average number through the year. Feed represented the largest single expenditure, being about 65% of the total. The fact that the average expense for purchased feed was over $5000 indicates the importance of feed prices. A ten per cent increase in price of feed without a corresponding change in price of poultry products would be disastrous to many poultry farmers. Hired labor was the next largest item of expense, representing 10% of the total. On five farms averaging less than 500 layers, the expense for labor was only 3% of the total. On some of the larger farms it ran to 17.7%.

Table 5—*Receipts — average 23 farms*

	Number	Value	Per cent
Market eggs	9955.3 doz.	$4392.18	43.5
Hatching eggs	1613.7 doz.	1124.09	11.1
Live fowl	634 birds	827.62	8.2
Ducks and geese		1.78	
Dressed fowl	167.8 birds	288.08	2.9
Pullets sold	111.7 birds	185.99	1.8
Cock birds, Live	49.7 birds	56.84	.6
Capons	2.4 birds	7.23	.1
Cock birds, Dressed	5.4 birds	6.79	.1
Cockerels	1.2 birds	3.10	
Roasters, Live	182.3 birds	225.89	2.2
Roasters, Dressed	17.7 birds	24.91	.3
Broilers, Live	1657.3 birds	1051.64	10.4
Broilers, Dressed	16.1 birds	20.28	.2
Started chicks	11.3 birds	6.52	.1
Day-old chicks	3339	675.60	6.7
Miscellaneous poultry receipts		48.26	.5
Grain sold		314.69	3.1
Trucking		35.95	.4
Commission on grain sold		9.91	.1
Custom hatching	2701.1 eggs	80.46	.8
Equipment sold		23.15	.2
Miscellaneous farm receipts		13.42	.1
Fruit		33.77	.3
Wood		4.43	
Crops		88.66	.9
Milk		45.82	.5
Other stock		19.61	.2
Rent of house to hired man		18.70	.2
Increase in value inventory		453.53	4.5
Total receipts		$10,088.90	

Monthly Relationship of Receipts and Expenses

In a business with large expenses, it is convenient, although not always of vital importance, to have fairly even distribution of the relationship between receipts and expenses. The grain bill alone averaged $434 per month per farm, and on one farm averaged $1048 per month; if income is delayed over many months, problems of finance arise which are difficult to overcome.

The average monthly income and outgo on the 23 farms as shown in Figure 1 were not constant. Both the expense curve and the income curve vary during the year and show no particular relationship to each other. The receipt curve was high in October and again in March, April and May, reaching a peak of $1100 in April. Receipts were below $750 in November, December, January, February, June and July. On the other hand, the expense curve was highest in April and lowest in November. Expenses exceeded receipts in January and June. The periods of greatest margin of receipts over expenses were during fall and spring.

Naturally, this monthly relationship of receipts and expenses varies greatly with different farms and is influenced by such factors as time of

Table 6—*Expenses — average 23 farms*

Expenses	Amount	Value	Per cent
Real estate		$348.47	4.4
Equipment, Poultry		232.73	2.9
Equipment, General		71.40	.9
Poultry feed		5212.42	65.
Supplies, Poultry		76.40	1.
Shavings	135 bales	53.76	.7
Straw	25.6 bales	18.32	.2
Peat	8.3 bales	18.24	.2
Coal		129.99	1.6
Day-old chicks	679.5	136.61	1.7
Poultry stock purchased	6.3 ckls.		
	17.3 pullets-hens	24.85	.3
Ducks purchased	.5	.26	—
Hatching eggs	2347.3 eggs	169.74	2.1
Hired labor	2608.6 hours	873.80	10.9
Miscellaneous poultry		181.61	2.3
Market eggs purchased	38.9 dozen	16.92	.2
Custom hatching	1163.6 eggs	42.53	.5
Testing and certification		64.83	.8
Taxes		145.43	1.8
Insurance		62.45	.8
Miscellaneous farm		49.48	.6
Other feed		34.97	.4
Truck		28.60	.4
Stock purchased		21.68	.3
Apples		3.16	—
Total expenses		$8018.65	

brooding operations, date of selling old fowl and type of poultry business.

Farms doing a strictly market egg business show a more uniform receipt curve. On eight farms the monthly receipts varied from $395 in February to $575 in June. In general the receipts were above $500 in October and November due to a combination of high seasonal egg prices and the sale of old hens, and again in June due to sale of broilers; and were below $450 in September, February, July and August. On the same group of farms the expenses were above $500 in March and April when chicks were purchased and brooding operations were under way. Expenses were below $400 in September, November, December and February. Expenses exceeded receipts during January, March, April and August.

On the other hand, eight farms doing a considerable hatching egg and baby chick business had high receipts in March, April and May due to sale of hatching eggs, chicks and broilers. The receipts were also high in August, September and October due to the high seasonal price of market eggs and sale of fowl. The expenses tended to be higher in March, April and May, the incubation and brooding season.

The monthly cash income, monthly cash expenses and relationship of the two are much more erratic in the case of individual farms since the averages discussed above tend to smooth out the differences. But the general average curves of income and expenses will serve to show the

FIGURE 1—Monthly relationships of cash receipts and expenses on eight market egg farms, on eight baby chick and hatching egg farms and on all 23 farms. (Taxes and insurance were allocated evenly over the 12 months.)

need of adequate financing in the periods of low margins over expenses. The advantages and economy of the various credit sources should be given careful consideration by the poultrymen, and perhaps some attention to organizing the business to avoid short-time credit.

Financial Returns

Receipts minus expenses, including allowance for changes in inventory, averaged $2070. This "farm income" is the return on capital invested and labor and management of the operator.

Assuming the returns on capital as 5% of the inventory, the interest would average $671 annually. This taken from the farm income would leave $1399 for returns on the operator's labor and management, or "labor income." As shown in Table 7, the labor income varied from -$726 to $8342. Six operators had minus labor incomes, five were between 0 and $1000, seven had between $1000 and $2000, and five had over $2000. The labor income per bird (using average number of birds) averaged $1.40. In addition to this, the family used farm products in the home,—not only poultry products, but a considerable amount of garden produce as well as milk and wood. Valuation of these items is shown in Table 8 on the basis of farm prices. In the case of eggs used in the home, value was placed at 25¢ per dozen, since most of them were cracked or dirty and rather difficult to market. The total average value of products from the farm used in the home was estimated at $248. It is well to recall also that the operator had a house to live in which might be conservatively estimated as worth $250 per year.

Table 7—*Farm income and labor income on individual farms*

Rank in income	Farm income	Labor income	Value of farm produce used in home	Labor income plus value produce used
23	-$393.55	-$726.67	$125.00	-$601.67
22	22.09	- 605.40	422.50	- 182.90
21	109.09	- 594.37	425.00	- 169.37
20	540.96	- 114.61	135.00	20.39
19	232.30	- 69.38	292.50	223.12
18	411.84	- 41.62	104.91	63.29
17	799.82	85.83	158.25	244.08
16	1554.99	687.91	552.00	1239.91
15	1303.42	735.13	130.00	865.13
14	1476.55	812.20	180.50	992.70
13	1299.16	936.00	340.00	1276.00
12	1446.44	1069.02	120.00	1189.02
11	1986.40	1272.76	622.00	1894.76
10	1789.31	1295.70	343.75	1639.45
9	2023.36	1369.36	305.00	1674.36
8	2192.00	1589.05	377.50	1966.55
7	2644.76	1628.77	168.75	1797.52
6	2048.23	1687.42	212.50	1899.92
5	2869.70	2095.14	100.00	2195.14
4	2784.53	2221.75	175.00	2396.75
3	3605.06	3020.37	190.00	3210.37
2	6691.33	5481.21	147.50	5628.71
1	10177.72	8342.36	85.00	8427.36
Average	$2070.25	$1399.05	$248.38	$1647.43

Table 8—*Farm products and estimated value used in home (Average 23 farms)*

Product	Estimated value
Pork	$1.09
Coal	1.39
Wood	71.09
Poultry	5.43
Fowl	27.09
Broilers	2.93
Roasters	2.83
Eggs	43.70
Milk	37.09
Garden	46.09
Miscellaneous	2.69
Butter	6.96
	$248.38

GENERAL DESCRIPTION OF MANAGEMENT

In a general way in the group of 23 farms, flock management practices were fairly well standardized. However, the details of management, which in many cases are the determining factors in success or failure, varied on the different farms.

Breeding Stock

Most New Hampshire poultrymen have used pullets for breeding stock for many years, and the enviable record of hatchability and livabilty of chicks indicates that this practice has not lowered the vitality of the stock. Increased egg production and size of bird indicate that progress has been made in breeding under the pullet system. Of late years, however, due mainly to prevailing lower prices of fowl and broilers, more poultrymen are making a practice of keeping over the best 20% of the birds for the second laying year and securing hatching eggs from these pens.

It has been estimated that 90% of the poultry population of the State are heavy breeds with Reds greatly predominating. The 23 flocks in this study were divided as follows: 19 Reds, 2 White Leghorns, 1 Reds and Leghorns, and 1 Reds and Rocks.

The New Hampshire Reds are an exceptionally early maturing strain. They mature at from four to five months, and have a body weight of 4½ to 5½ pounds when housed, and usually 6 or 6½ pounds at the end of the first laying year. Certain strains exceed this weight.

Management of Layers and Breeders

The birds are housed in permanent quarters in pens of 100 to 300 at about the time laying commences. Very few poultrymen have yards for the layers, and in most cases the birds are never allowed out of doors after being placed in the laying pens.

The type of house varies, although in nearly all cases an open front is used. On many farms, old dairy barns have been remodelled into poultry houses with three to four decks. Three to four square feet of floor space per bird is usually allowed—3.47 square feet for the Red flocks and 3.31 square feet for the three Leghorn flocks. None of the farms furnished the birds with artificial heat.

Mash was kept before the birds at all times. The majority of the poultrymen fed commercial mashes, although some were using the New England Conference Ration, or a formula of their own based on the conference ration. The method of scratch feeding varied. Some men fed scratch in hoppers and kept it before the birds at all times, thereby allowing them to adjust the mash-scratch ratio according to their body requirements. Others fed a definite amount morning and night, limiting the quantity according to the condition of the birds. Still other variations of scratch feeding systems were found. A wet mash was generally fed during certain periods either to stimulate production or, with fattening ingredients, to prevent fall molt in early hatched pullets. Green feed was also used extensively; germinated oats were most popular, with cabbage and mangles following. Those men not feeding an accessory green or succulent generally incorporated alfalfa leaf meal in the mash. Cod liver oil or cod liver meal was generally fed during the entire period that the layers were housed. Only two of the 23 farms were using liquid milk. Condensed or semi-solid buttermilk was more popular.

Thirteen farms used lights on their laying flocks, turning them on in such a way as to allow the birds a twelve or thirteen hour day. Over half the farms furnished the layers warm water during the cold weather period, either by carrying or through the use of heated fountains. Shavings, straw, peat or hay were used for litter.

Brooding and Rearing

Colony houses are still the most common type of brooder building in New Hampshire, although most of the newer plants use the permanent continuous type. On four farms chicks were brooded in these new type, continuous hot water brooder systems with a central source of heat. On four other farms the newly hatched chicks were kept in batteries for two or more weeks. The other farms brooded chicks with a stove in each pen.

One of the larger poultry plants that co-operated in the study

Where batteries were not used, the chicks after removal from the incubator were placed under the brooder canopy and feed was generally placed before them immediately. In all but a few cases, scratch was not fed until the third or fourth week. Most poultrymen fed nothing but a starting mash for the first few weeks. Generally, the birds were kept in confinement until nine or ten weeks of age when they were either placed on range in the common New England range shelter or were allowed to range in front of the brooder house. A few farms had wire porches for use the first nine or ten weeks.

Pullets were placed on unlimited sod range at nine or ten weeks of age. The usual practice was to use a range once in three years, leaving it idle for two years. This, of course, required three ranges used in rotation.

Fifteen farms had piped water to the range, and eight of these had installed automatic fountains.

LABOR

On the 23 farms, an average of 6087 hours of man labor was accounted for. Of this amount 3234 hours, or 53% of the total, was provided by the owner; 2609 hours, or 43%, by hired labor; and only 245, or 4%, by the owner's wife or other members of the family. The amount of poultry farm work done by members of the family other than the operator was very small, averaging only about forty minutes per day per farm. Considering the average size of flocks to be 1290 at the maximum, the amount of hired labor required seems large. The 23 farms employed 14 hired men on a full time basis, and in addition a total of 16,322 hours of hired seasonal or part time labor. The cost of this hired labor, including in a few cases an estimate on value of board provided, was $20,092.61, or $874 per farm. The average cost of all labor hired, including both regular and extra, was 33.4¢ per hour.

Table 9—*Man hours monthly expended by owner and others — average of 23 farms*

Month	Hours expended by				Cost of hired labor	Total hours labor
	Owner	Wife	Other unpaid labor	Hired labor		
September	254.9	13.6	....	177.2	$60.66	445.7
October	266.3	10.6	1.7	198.0	59.83	476.6
November	257.1	10.4	1.8	190.0	74.90	459.3
December	267.2	10.6	1.7	193.5	65.70	473.0
January	272.0	13.2	1.8	191.3	65.71	478.3
February	261.0	13.0	3.9	180.5	60.71	458.4
March	291.0	18.3	18.4	230.0	75.61	557.7
April	300.0	27.0	5.9	256.8	83.01	589.7
May	278.6	34.5	....	278.6	89.92	591.7
June	274.0	18.3	2.8	237.3	77.97	532.4
July	254.0	17.9	2.0	240.7	81.75	514.6
August	258.1	11.9	5.3	234.7	77.83	510.0
Total	3234.2	199.3	45.3	2608.6	$873.59	6087.4

Monthly labor requirements varied considerably, but the expenditure was evened up somewhat by work on odd tasks, repairs, building, etc., during the dull periods. The amount of labor needed is naturally largest during the brooding season before the young stock is put on the range. On the average farm this peak labor requirement is in March, April and May, and is partly taken up by longer working days on the part of the owner himself. Note in Table 9 that the owner's labor in hours per month jumps from 255 in September to 291 in March and 300 in April. The requirements drop off in June and are lowest during the fall and winter.

Division of Time

Work on poultry farms consists of so many small and varied operations and shifts so greatly from day to day that accurate figures on division of time are very difficult to obtain. However, through monthly estimates by the poultrymen data were secured which give the approximate division of time of the daily regular chore work. A fairly large proportion of total labor comes under the classification "miscellaneous poultry," which includes work such as cleaning pens, moving birds, marketing, dressing fowl, and all time on poultry aside from regular chore work. It is interesting to note in Table 10 that "chore" work accounts for about 75% of the total labor expended.

Table 10—*Man hours spent on hens, chicks, incubation, etc., by months — Average 23 farms*

Month	On hens	On chicks	On incubation	On miscellaneous poultry	On real estate	On outside labor	On miscellaneous farm	Total labor
	hours	hours	hours	hours	hours	hours	hours	hours
September	196.9	68.3	....	113.2	13.3	2.6	51.4	445.7
October	216.7	35.6	....	142.1	17.8	....	64.4	476.6
November	217.4	17.1	3.7	157.8	8.4	....	54.9	459.3
December	225.2	14.9	6.3	175.2	.9	....	50.5	473.0
January	221.9	30.1	12.7	165.2	2.4	....	46.0	478.3
February	213.6	64.2	22.3	118.8	3.3	....	36.2	458.4
March	197.2	145.8	31.6	140.0	6.5	....	36.6	557.7
April	196.5	225.2	28.4	91.1	3.9	2.6	42.0	589.7
May	182.2	237.7	16.2	86.1	5.2	2.6	61.7	591.7
June	173.5	203.7	1.7	90.0	4.8	2.6	56.1	532.4
July	172.0	168.8	....	95.7	7.0	....	71.1	514.6
August	190.4	124.3	....	133.3	9.4	2.6	50.0	510.0
Total	2403.5	1335.7	122.9	1508.5	82.9	13.0	620.9	6087.4

As would be expected, labor on the laying flock represents the largest item, accounting for 39.5% of the total labor for the year. This daily chore work on hens is largest from October to February, when the number of layers is largest, and is at the lowest point during June and July. (Fig. 2)

Labor on brooding and rearing young stock is not very high until March and reaches its peak in April and May. Naturally, labor require-

ments for young stock drop off as soon as the birds are put on range, which on most farms was in June.

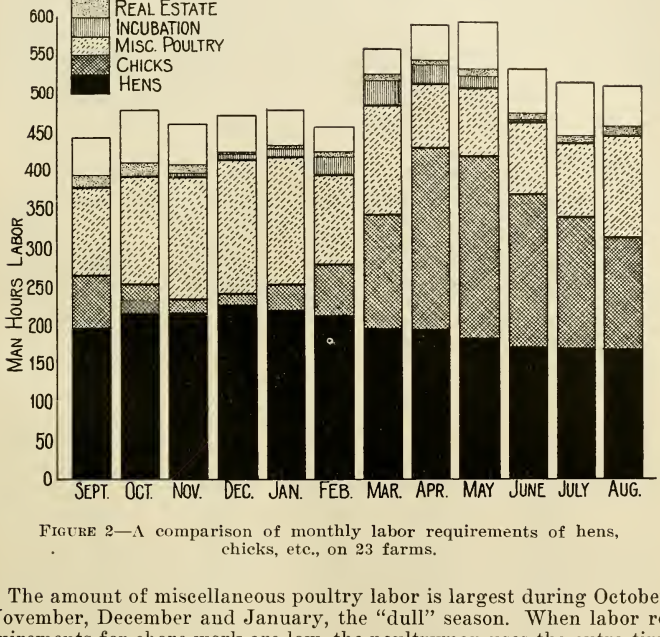

Figure 2—A comparison of monthly labor requirements of hens, chicks, etc., on 23 farms.

The amount of miscellaneous poultry labor is largest during October, November, December and January, the "dull" season. When labor requirements for chore work are low, the poultryman uses the extra time by making repairs on poultry equipment, moving brooder houses and range shelters to new locations, and cleaning and spraying houses. With the approach of the busy brooding season the time available for this miscellaneous work naturally becomes less, and the labor on odd jobs drops off. The miscellaneous farm work on crops or animals not connected with poultry amounted to only 620.9 hours per farm, or about 10% of the total.

Comparison of Labor on Laying Flocks

The regular chore work on hens on the 23 farms averaged 2.4 hours per hen annually, ranging from 1.1 hours on Farm 11 to 5.8 hours on Farm 6. (Table 11)

On the 14 farms with less than 1000 hens, the daily chores on laying flocks averaged 2.7 hours per hen per year, and on the 9 farms with over 1000 hens, 2.2 hours. The men with larger flocks tended to have more efficient equipment and to use their time to better advantage. The

daily chore work was not the only time spent on hens, but it offers a good comparison between farms. When the miscellaneous work on hens is included, the comparison is not as complete because different poultrymen carry their services to different phases of the production and marketing program. Some packed their eggs in cases without grading or candling and sold to peddlers weekly. Others carefully graded and even retailed eggs. Some sold the broilers or fowl at wholesale in one lot without much attention to selection. When all the labor (including miscellaneous) on hens is included, the average was 3.3 hours per hen per year, and the range was from 2.1 to 7.2 hours.

Table 11—*Comparison of man labor on chore work on 23 farms*

Farm number	Average number layers	Total hours chores on layers	Hours per layer	Number of pullets raised plus breeding cockerels	Total hours chore work on raising pullets	Hours chore work per 100 pullets raised
1	991	2224	2.2	2048	969	47
2	471	1010	2.1	721	619	86
3	654	1945	3.0	1855	3184	172
4	2548	5370	2.1	4300	1959	46
5	1040	2115	2.0	1825	1119	61
6	354	2057	5.8	985	1879	191
7	697	1571	2.2	1346	925	69
8	676	1630	2.4	811	717	88
9	1519	2735	1.8	1915	964	50
10	967	2756	2.8	1855	1313	71
11	1614	1715	1.1	3508	1598	46
12	2105	7386	3.5	2620	3429	131
13	836	2240	2.7	1175	898	76
14	495	1380	2.8	800	910	114
15	704	1467	2.1	812	852	105
16	458	947	2.1	772	862	112
17	583	1183	2.0	1410	931	66
18	1117	2086	1.9	1500	1034	69
19	687	2220	3.2	1262	1371	109
20	1107	2749	2.5	1180	785	66
21	484	1483	3.1	1210	847	70
22	1356	2798	2.1	2364	1996	84
23	1433	3158	2.2	2270	999	44
Total	22896	54225		38544	30160	
Weighted average			2.37			78

Comparison of Labor in Rearing Pullets

In the production of pullets, the regular chore work per 100 pullets raised averaged 78 hours, with a range of 46 to 191 hours. On 13 farms the time on pullets was below 80 hours per 100 pullets, and on 7 farms, it was over 100 hours. The 13 smallest flock of pullets raised used 90 hours, and the 10 largest flocks used 71 hours per 100 pullets.

Labor Efficiency

When the farms are grouped by average number of layers, the total hours of labor is greater for the larger flocks, but the total hours per bird decreases from 10 hours in the less-than-500-birds group to approximately 5 hours per hen in the 1001-1500 group. (Table 12.) On larger farms no significant change appears in hours per bird. It is well to note that in the flocks of over 1000 birds about one half as much labor was required per bird as in flocks under 500 birds.

Table 12—*Labor requirments and size of farm — Labor summary*

Average number birds for year	Number farms	Average number birds	Hours man labor			Average cost hired man labor	Percent of total labor hired
			Average per farm	Average per 100 birds	Average hired per farm		
Less than 500	5	406	4064	1000	339	$128.11	8.3
501 — 1000	9	755	5743	761	2194	644.93	38.2
1001 — 1560	5	1211	6023	497	2910	1052.26	48.3
1501 — 2000	2	1567	7510	479	4069	1330.98	54.2
Over 2000	2	2326	11428	491	7934	2836.68	69.4
Average all farms	23	995	6087	611	2609	$873.59	42.8

The explanation of this wide difference in efficiency may lie partly in the fact that the man with 500 birds spends more time because he has proportionally more time to spend. He is disposed to use freely the time which he has available. With a change in philosophy and in methods, perhaps he could just as well take care of more birds.

Of course, most of the 500-bird flocks are operated by those just entering the business or those feeling their way financially before expanding too rapidly. If they are successful, in a few years they will have the ability and capital to have a larger unit. The small farms are often lacking in labor-saving equipment and in organization of work to do things quickly.

It is difficult to compare operations between farms because the men combine jobs in different ways to such an extent that the time required to do one particular task is indefinite. Gathering eggs, for instance, is associated with watering at noon, with feeding at night and with culling in the morning.

High labor requirements were due to one or more of the following factors:

1. Poor arrangement of buildings, requiring much travel in feeding, gathering eggs, etc.
2. Poor water system, requiring much additional time in lugging water, cleaning utensils, etc.
3. Unsystematic organization of daily chore work.
4. Poultry in very small units requiring extra attention.
5. Unhandy equipment or poor interior arrangement of pens.
6. Physical ability of operator.
7. Uneconomic management practices requiring large labor expenditure.

In many instances, the use of extra labor resulted from lack of available capital rather than from lack of understanding of the problem. Farms with inadequate equipment were considering changes to save labor as fast as their capital warranted.

Practically every farm contributed some rather ingenious labor-saving method or device. On one farm the operator had practically cut out the large amount of labor necessary to clean dropping boards by merely placing his roosts over a wire-mesh frame. The droppings thus required cleaning only a few times a year. In spite of the fact that this method was wasteful of space it suited that particular poultryman's conditions. On several farms were found home-made automatic watering devices, automatic switches for turning on lights in laying pens, central heating plants for brooding, carriers and many other devices for saving labor.

Hired Labor

On the small farms about 8% of the total labor, or 339 hours, was hired, and on the large farms 69%, or 7934 hours. The cost of this labor averaged $128 on the small farms, and $2837 on the large farms. The nine farms in the 501-1000 bird size found it necessary to hire 38% of their total labor, which represented an out-of-pocket expense of $645.

In contrast to these rather large expenditures for labor was the situation on certain individual farms. For instance, Farm 18, with an average of 1117 layers and a baby chick business, hired only 250 hours of labor, representing an expenditure of only $84. In other words, on this particular farm of over 1000 birds only 7% of the total labor was hired. The efficiency comes from well-planned daily chores and a well organized plant layout.

This matter of hired labor is of tremendous importance to the individual poultryman, and with threatened lower margins will in the future need to be given more attention. The size of business must be adjusted to the available labor. On a one-man plant, sufficient layers should be housed to use the operator's time to best advantage. The number will, of course, depend on the physical ability of the operator and the type of poultry business. The operator who expects to keep a year-round man should plan not only to have business of sufficient size to keep both the hired man and himself busy but to use the time advantageously. Some of the farms have more layers than one man can care for conveniently, and yet not enough to keep a hired man employed to advantage at all times; under these circumstances the operator and the man put in the time but do not operate efficiently during most of the year. An increase in size of business beyond the point where outside or additional labor must be employed should be planned only when the additional income will more than offset the additional expenses, including the cost of extra labor.

FEED CONSUMPTION OF LAYERS

Pullet Layers (Heavy Breeds)

Accurate daily feed consumption and egg production records were secured on 15 of the 23 pullet-laying flocks (all heavy breeds) representing a total of 10,879 birds for the year. From these data the relationship between weekly feed consumption and weekly production of eggs was studied.

It will be noted in Figure 3 that the feed consumption curve and the egg production curve rise and fall somewhat in unison. Increased production is accompanied by increased feed consumption, and those who attempt to increase production at certain periods resort to wet mashes, etc., to get the birds to eat more. Lighting of laying pens, through increasing the length of day, also makes it possible for the laying birds to assimilate more feed.

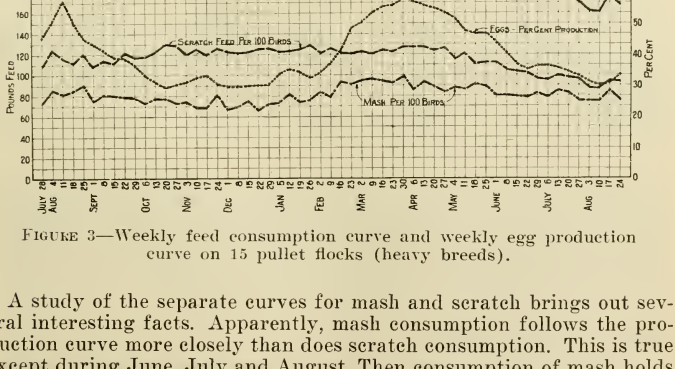
Total Feed Per 100 Birds
Scratch Feed Per 100 Birds
Mash Per 100 Birds
Egg - Per Cent Production
Pounds Feed
Per Cent
July 28
Aug 4 11 18 25
Sept 1 8 15 22 29
Oct 6 13 20 27
Nov 3 10 17 24
Dec 1 8 15 22 29
Jan 5 12 19 26
Feb 2 9 16 23
Mar 2 9 16 23 30
Apr 6 13 20 27
May 4 11 18 25
June 1 8 15 22 29
July 6 13 20 27
Aug 3 10 17 24

Figure 3—Weekly feed consumption curve and weekly egg production curve on 15 pullet flocks (heavy breeds).

A study of the separate curves for mash and scratch brings out several interesting facts. Apparently, mash consumption follows the production curve more closely than does scratch consumption. This is true except during June, July and August. Then consumption of mash holds up while production drops. This is largely due to attempts to stay the rapidly dropping production by wet mashes.

In the case of scratch consumption, the curve rises from September 15th on, in spite of the fact that production drops very low. This is undoubtedly due to the increased energy requirements of the birds in maintaining body heat during the cold weather.

Table 13 consists of a summary on the individual farms of average feed consumption per bird (per week), together with the average per cent production for the year, and feed per one dozen eggs. The weighted average per bird per week for these flocks shows .81 lbs. mash, 1.19 lbs. scratch, 2.00 lbs. total feed. Of the total feed, 40.5% was mash. Thus on an annual basis, it required 42.1 lbs. of mash, 61.9 lbs. scratch or a total of 104 lbs. of feed to keep a laying bird. The aver-

age production on these flocks was 39.3%. Using average feed consumption and average production on these flocks, 8.71 lbs. of feed was required to produce a dozen eggs. The variation in amount of feed per week in the individual flocks was from 1.75 lbs. to 2.24 lbs.

Table 13—*Average weekly feed consumption per bird and per dozen eggs on 15 pullet flocks*

Farm number	Mash	Scratch	Total feed	Per cent mash	Per cent production	Feed per dozen eggs
	lbs.	lbs.	lbs.	%	%	lbs.
18	.68	1.21	1.89	36.0	39.8	8.14
22	.48	1.37	1.85	25.9	37.9	8.37
6	.73	1.09	1.82	40.1	44.3	7.04
1	.91	1.13	2.04	44.6	42.5	8.23
21	.73	1.13	1.86	39.2	43.2	7.38
16	.87	1.18	2.05	42.4	39.4	8.92
5	.66	1.22	1.88	35.1	36.1	8.93
23	.89	1.20	2.09	42.6	39.6	9.05
7	.77	1.20	1.97	39.1	41.5	8.14
14	.92	1.11	2.03	45.3	42.0	8.28
13	.98	1.23	2.21	44.3	39.9	9 50
9	.75	1.10	1.85	40.5	40.4	7.85
3	.83	.92	1.75	47.4	27.0	11.11
8	.94	1.01	1.95	48.2	41.0	8.15
11	.96	1.28	2.24	42.9	40.1	9.58
Weighted Average	.81	1.19	2.00	40.5	39.3	8.71

In spite of the fact that the weekly feed consumption and weekly egg production seem to fluctuate together when all the farms are grouped together as indicated in Figure 3, there appears to be little relationship between annual feed consumption and production when individual farms are compared with each other. This is probably due to differences in strain of birds, in management, and in feed.

Old Hens (Heavy Breeds)

In the same way, figures on feed consumption and egg production were obtained on six lots of old hens, representing an average of 647 birds for the year. The relationship between feed consumption and production was not found materially different from that of pullets. However, the proportion of scratch to mash sums higher in the case of old hens.

A summary of the feed consumption and production of the individual flocks is shown in Table 14. It will be noted that average feed consumption per bird per week was slightly lower than that of pullets: 1.9 lbs. compared to 2. lbs. Of this total, only 34% was mash, as compared to 40.5% for pullets. Production of old hens was lower. Amount of feed per one dozen eggs was much higher, 12 lbs., as compared with 8.7 lbs. for pullets. In other words, it took 3.3 lbs. more feed to produce a dozen eggs from old hens.

Table 14—*Average weekly feed consumption per bird and per dozen eggs on six old hen flocks*

Farm number	Feed consumed per bird per week			Per cent Mash	Per cent production	Feed per dozen eggs
	Mash	Scratch	Total feed			
	lbs.	lbs.	lbs.	%	%	lbs.
18	.68	1.23	1.91	35.6	25.7	12.74
22	.46	1.51	1.97	23.3	26.0	12.99
6	.74	1.03	1.77	41.8	35.4	8.57
1	.65	1.15	1.80	36.1	22.4	13.74
21	.47	1.33	1.80	26.1	24.6	12.54
16	.93	1.13	2.06	45.1	28.7	12.42
Weighted Average	.65	1.26	1.91	34	27.4	11.96

Weekly Feed Consumption Per Dozen Eggs

The week-by-week feed consumption per dozen eggs is, of course, influenced by changes in the rate of production of eggs and to some extent by season of the year.

The average feed consumption was 8.7 pounds of grain per dozen eggs in the pullet flocks and 12 pounds in the old hen flocks. As shown in Figure 4, the feed requirement of pullets per dozen eggs was greatest during the months of October, November and December—the period of lowest production. It varied from a peak of 12.2 lbs. in October when production was 29%, to 5.3 lbs. in March when production was 55%.

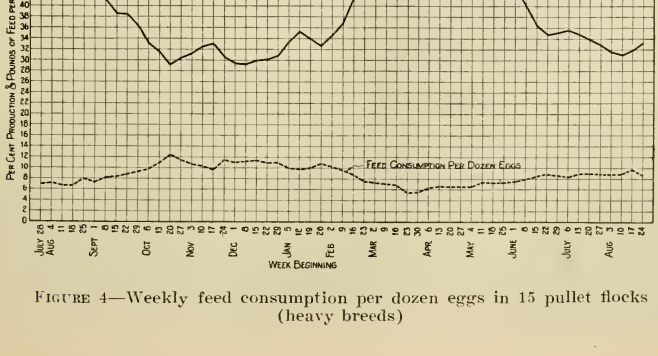
Per Cent Production & Pounds of Feed per Doz Eggs
Percent Production
Feed Consumption Per Dozen Eggs
July 26
Aug 4 11 18 25
Sept 1 8 15 22 29
Oct 6 13 20 27
Nov 3 10 17 24
Dec 1 8 15 22 29
Jan 5 12 19 26
Feb 2 9 16 23
Mar 2 9 16 23 30
Apr 6 13 20 27
May 4 11 18 25
June 1 8 15 22 29
July 6 13 20 27
Aug 3 10 17 24
Week Beginning

Figure 4—Weekly feed consumption per dozen eggs in 15 pullet flocks (heavy breeds)

In contrast to this the feed consumption per dozen eggs in old hen flocks varied from 6.7 lbs. in March with 50% production to the very high requirement of 60.8 lbs. in November, when production was only 5%. Old hen flocks took over nine times as much feed per dozen eggs in November as in March. Of course, while these weekly comparisons are interesting, the situation over the year period is of much greater significance. However, a study of Figure 5 does indicate that, on the

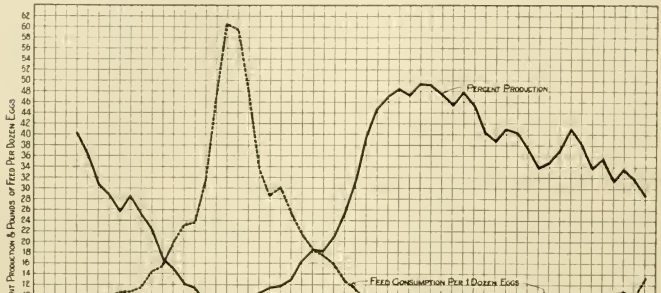
Percent Production & Pounds of Feed Per Dozen Eggs
Percent Production
Feed Consumption Per 1 Dozen Eggs
July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug
Week Beginning

Figure 5—Weekly feed consumption per dozen eggs in 6 old hen flocks (heavy breeds)

average, old hens are carried several months in the fall at a considerable net feed cost. It is roughly estimated, for instance, that in the four months of October, November, December and January the product of 100 old hens assuming average rate of mortality and culling would be 121 dozen eggs, worth approximately $70, while the feed cost would be 2995 pounds, or approximately $75. Thus, under price conditions at the time of the study the income from egg production from old hens was not sufficient to cover feed cost from October to February. In this case, the poultryman has much the same problem that the dairyman has with respect to carrying dry cows over a long period.

MORTALITY AND CULLING

Mortality

The average mortality of the laying flock based on the maximum number of birds was 16.9 per cent. In other words, out of 100 birds housed in the fall 16.9 died before the year was up. The actual number that died averaged 217.6 birds per farm. The per cent mortality figure was obtained by dividing the actual number that died (217.6) by the maximum number of birds (1290.3) housed per farm. The mortality per farm ranged from 5.6 to 35.9%. Only 5 farms had less than 10% mortality on layers; 6 farms had from 10-15%; 4 farms had from 15-20%; and 8 farms had over 20%.

There was apparently little correlation between the size of the flock and the mortality since both large and small flocks are well scattered in all the mortality percentage groupings.

The actual weekly mortality per farm did not vary greatly throughout the year. Losses were slightly heavier during March, April, May and June, the period of heaviest production, averaging over 5 birds per farm per week during that period. At other seasons the losses averaged less than 4 birds per week per farm.

Estimated at meat prices, the average loss of 218 birds per farm from the laying flock would amount to about $300. The actual loss in many instances may be much greater than the value of the birds for meat, since heavy losses early in the laying period reduce the potential earning capacity of the flock.

Mortality in old hens, based on number of old hens kept over for a second year, was 18%. Mortality in pullets was 16.2%. The difference is slight and probably not significant.

Culling

Out of a maximum number of birds per farm of 1290, culling during the year removed 850, or 66%. Mortality removed another 17%, leaving only 17% of the original birds to be inventoried at the end of the year. Heavy culling started about June 15 and reached its peak about October 1, when housing room was needed for the new crop of pullets. Culling from November to May was low and nearly constant, averaging about 11 birds per week per farm.

It is quite probable that too heavy culling of the market-egg birds is practiced on many farms. Such culling during the winter and spring leaves the poultryman with a greatly depleted flock in July and August. But on the other hand, many poultrymen cull too little. A careful daily check on the condition of individual birds is advisable, as certain birds in good flesh can be taken out and marketed as poultry meat which otherwise in a few days would show marked evidence of decline and would later appear as a loss.

Culling of healthy birds merely because their production is below certain standards can be carried to extremes. Their removal from the laying flock does not decrease the general overhead. Depreciation, insurance, taxes and labor usually continue about as before. On a farm that is housing birds to capacity, culling would have little effect on expense except to reduce the total cost of feed. The decision of whether to cull or not can be made largely on the basis of returns in relation to feed cost. For instance, a pen of 100 birds would consume approximately 200 lbs. of feed in a week, which at present prices would cost about $3.50. When eggs are worth 35 cents, ten dozen or 17% production would pay for the grain; at 25 cents, fourteen dozen or 24% production would be needed to balance. As long as the equipment, buildings and labor are available, something above feed cost may be better than nothing.

Or based on a year's production and assuming that a low producer will lay most of her eggs during the low priced spring period, if she is able to lay more than enough to pay for 104 lbs. of feed, this small income may be better than none.

If we assume a farm with capacity for 1000 hens and with available family labor and if it is further estimated that 250 of these hens will produce only 100 eggs per year, culling them might reduce the gross returns $600. The gross expenses might be reduced $500. Thus if these birds were left in the flock the operator would have $100 more cash at the end of the year.

It is desirable to grow more pullets than are required and then to eliminate carefully the poorest prospects until the number is equal to the capacity of the housing. The farm can then operate to capacity through most of the year, and the culled pullets can probably be sold for enough to pay for their cost.

The above discussion of culling applies only to market-egg flocks. The breeder or producer of hatching eggs and baby chicks cannot be too strict in his selection of birds in the fall nor in his culling throughout the breeding season.

Rate of Decrease in Population of Laying Flock

The size of the laying flock during the various periods of the year is dependent on three factors: (1) removal of birds through death—mortality; (2) removal of birds for sale or use on the table—culling; (3) addition of birds to the laying flock by housing or by purchase.

The number of birds each week in the average laying flock is shown in Figure 6. The maximum size of flock was reached the week of No-

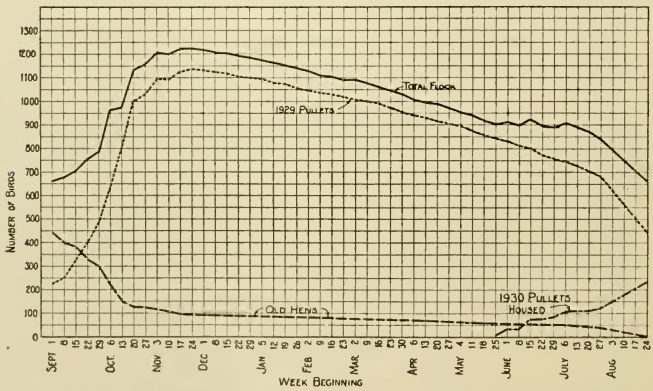

Figure 6—Average weekly size or population of 23 laying flocks.

vember 17. Due to culling and mortality the number declined gradually and at nearly a constant rate until about June 1. In spite of the fact that culling was particularly heavy from June on, the rate of decline slackened because of the addition of early hatched birds from the new crop of pullets. However, in spite of this increase, the total number of birds dropped rapidly after July 1, reaching a low point about the first of September.

This rate of decrease in the laying flock from a maximum point as well as the date of maximum population naturally varied considerably on different farms. In order to study this difference, the number of layers in four individual flocks each week is charted for the year on the percentage basis in Figure 7. The maximum number housed is consid-

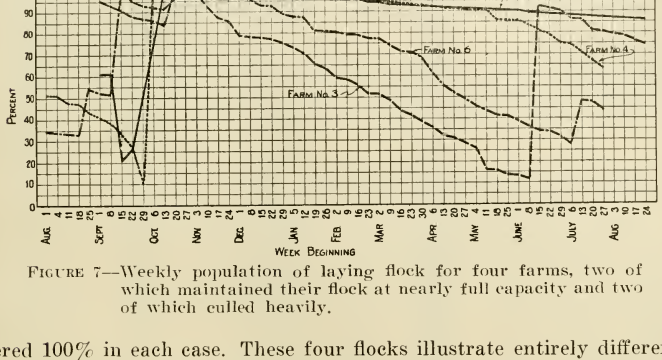

Figure 7—Weekly population of laying flock for four farms, two of which maintained their flock at nearly full capacity and two of which culled heavily.

ered 100% in each case. These four flocks illustrate entirely different practices in respect to culling. Flocks Nos. 8 and 4 show only a very gradual decline in number of birds from the peak about October 1. Apparently very little culling is done on these farms during the fall, winter and spring. In the case of Flock 8, out of the 100 birds housed in October, 86 were still on hand the following September 1. In the case of Flock No. 4, heavy culling did not commence until May 11. These two flocks operated at nearly full capacity, as far as number of birds was concerned, for the greater part of the year.

In contrast to these flocks, Farms Nos. 6 and 3 culled heavily. On the last named flock, heavy culling started immediately after the birds were housed in the fall and continued until June, when the flock was replenished by the addition of a new crop of early hatched 1930 pullets. Culling was so extremely heavy in this flock that out of each 100 birds of October 20, only a few over 40 remained by the middle of March, only five months later. By June 1, the flock was reduced to only 12% of the maximum number of birds. It is obvious that this last mentioned poultry plant was run at full capacity for only a very short period.

Per Cent of Housing Capacity for the Year

A comparison of the average per cent of capacity at which the laying flock was maintained on the various farms is of value as a measure of efficiency. The estimate in Table 15, based on a direct comparison between the average number of birds for the year with the maximum number in the fall, shows that the farms varied from 89% to 65.2% of full capacity.

Table 15—*Maximum and average number of birds in 23 laying flocks and the per cent of capacity for the year*

Farm number	Maximum number birds	Average number birds for year	Per cent capacity per year	Per cent production
1	1273	991	78	39.9
2	610	471	77	33.9
3	1004	654	65	30.9
4	3099	2548	82	49.7
5	1307	1040	80	34.8
6	513	354	69	43.9
7	995	697	70	40.6
8	761	676	89	40.6
9	1936	1519	78	36.9
10	1341	967	72	37.8
11	2126	1614	76	40.0
12	2727	2105	77	43.0
13	1060	836	79	38.0
14	751	495	66	41.0
15	1057	704	67	39.3
16	613	458	75	36.4
17	862	583	68	39.0
18	1314	1117	85	35.9
19	1000	687	69	40.9
20	1350	1107	82	39.0
21	575	484	84	40.5
22	1731	1356	78	34.9
23	1673	1433	86	38.4
Total	29678	22896		
Average — all	1290	995	77	39.7

Six farms maintained an average number of birds of over 80% of full capacity; 8 farms from 75% to 80%; 3 farms from 70% to 75%; and 6 farms were below 70%. On the average the farms maintained an average population of layers at 77% of the maximum housed in the fall.

Heavy culling may improve the per cent production of an individual flock, but a comparison of the last two columns of Table 15 shows little correlation. The six farms which maintained an average number of birds of over 80% of capacity had an average production of 43.4%. The six farms below 70% of capacity averaged 40.5%.

EGG PRODUCTION

The seasonal production of eggs is influenced by the date of hatch of the laying flock. It will be noted in Table 16 that most of the birds on the 23 farms were hatched in February, March and April, 1929. Only 5% were hatched earlier than February 1, and on the other hand, only 16.6% after May 1.

Annual Egg Production

Based on average number of birds, the average flock production per layer was 145 eggs. When expressed in per cent production, the average was 39.7%. Variation in flock production on individual farms was from 113 to 181 eggs per bird. Only three flocks averaged over 150

eggs. Eleven flocks averaged between 140 and 150; five between 130 and 140, and four between 110 and 130 eggs.

The pullets in all 23 flocks produced approximately 150 eggs per bird, or 41%. Only one flock was below 130 eggs. Four were between 130 and 140, eight were between 140 and 150, and ten were over 150 eggs.

The production of old hen flocks, which made up about 12% of the total number of layers, was considerably lower than that of the pullets, being only 112 eggs, or 31% per bird. This is 38 eggs less than the average pullet production.

Toward the end of the year, there were a few pens of early hatched pullets housed. The production of these 1930 pullets averaged 20.8% for the short time before the records were closed, and is included although the period was so short that there was little effect on the flock production for the year.

Table 16—*Distribution of dates of hatch showing number of pullets hatched by months in laying flocks on 23 farms in 1929*

Farm No.	Number of pullets						
	Dec.	Jan.	Feb.	Mar.	April	May	Total
22	...	....	800	589	....	....	1389
11	...	....	735	252	430	650	2067
5	...	....	900	397	....	....	1297
23	...	....	600	975	....	....	1575
10	...	....	233	233	233	234	933
15	...	....	....	....	842	....	842
13	...	....	....	829	240	....	1060
17	...	....	....	431	431	....	862
14	...	....	....	751	....	....	751
19	...	175	....	825	....	....	1000
18	...	....	....	170	427	430	1027
7	...	645	....	....	350	....	995
6	...	....	176	107	243	....	526
3	130	145	145	....	300	142	862
9	...	....	....	1936	....	....	1936
16	...	....	....	....	....	484	484
1	...	....	450	370	....	255	1075
2	...	....	....	....	370	240	610
21	...	271	....	140	120	....	531
8	...	....	....	....	659	102	761
20	...	....	....	450	450	450	1350
12	...	....	....	....	1076	1076	2152
4	...	....	....	1400	1250	456	3106
Total number	130	1236	4039	9846	7421	4519	27191
Per cent	.5	4.6	14.8	36.2	27.3	16.6	100%

Egg Production by Weeks

Figure 8 indicates the average percentage production by weeks for pullets, old hens and the flock as a whole on the 23 farms. Flock production was high from the last week in February to the first of June with a peak in the week beginning March 30; the low per cent produc-

tion was in October, November and December. In a general way, this production curve is inverse to the price curve, suggesting that this group of poultrymen is probably little better than the average in securing high production during the period of high seasonal prices.

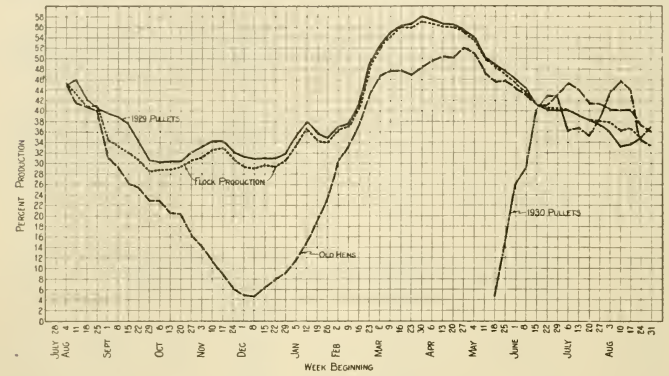

Figure 8—Average weekly percentage egg production curves on 23 farms.

Of particular interest is the comparison of old hens and pullets. Production of old hens dropped off rapidly after September 1 and reached the low point of 5% on December 1. After this date it increased rapidly, reaching 43% by March 1 and a peak of 52% the last of May. Spring production of old hens was nearly as high as that of pullets, while summer production averaged slightly higher.

Since the old hens were very low in production in the fall when the seasonal high price indicates a shortage of fresh eggs, the practicability of keeping old hens instead of pullets for market eggs may be questioned. This question will be analyzed in detail later under comparison of costs.

Keeping old hens for breeding purposes is another question, and probably is an efficient method of maintaining and improving the quality of the stock. High production in the early spring after a long rest is ideal for the production of vigorous chicks. Hens which have survived a year of rigorous culling and hardship may be important as breeders. In this case, the low fall production when market eggs are high is largely offset by good production when hatching eggs are needed.

Seasonal Production on Individual Farms

Seasonality of egg production varied greatly on different farms. In Figures 9 and 10, the per cent production is illustrated by curves for four individual farms. Flocks 6 and 4 show a high production in August, while Flocks 3 and 2 do not come to high production until after the first of the year.

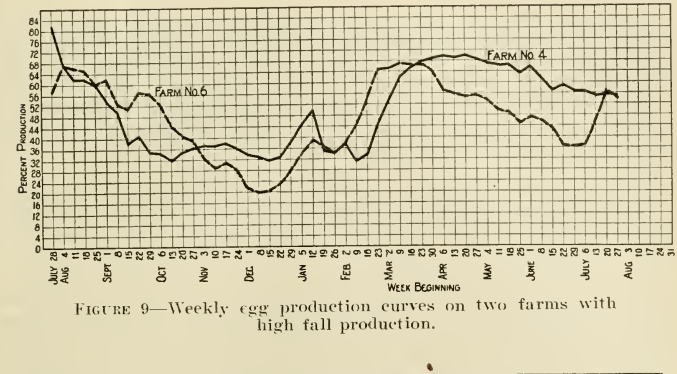

Figure 9—Weekly egg production curves on two farms with high fall production.

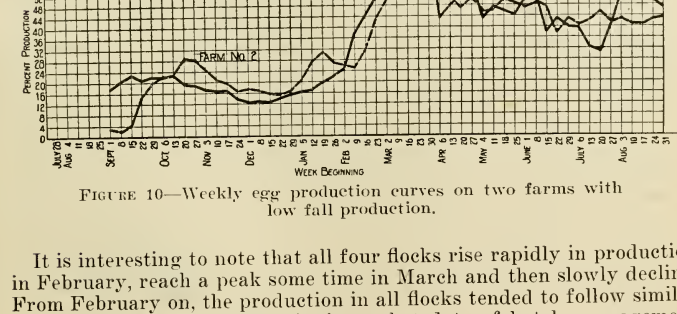

Figure 10—Weekly egg production curves on two farms with low fall production.

It is interesting to note that all four flocks rise rapidly in production in February, reach a peak some time in March and then slowly decline. From February on, the production in all flocks tended to follow similar curves. This would seem to indicate that date of hatch, management and history of production previous to March 1 has little or no effect on spring laying.

Individual farms fluctuated more widely in production than is shown in the curve of average production in Figure 8. The averaging of all farms tends to smooth the production curve. In the case of Flock 3, the variation was from 12% to 72% — a spread of 60%.

Flock 6 consisted largely of early hatched pullets. These birds laid heavily in July, August and September, then declined in production and went through a molting or rest period of about two months, when they dropped as low as 20%. The flock began to pick up in production in December, reaching a peak of 52% about the first of March.

Flock 4, also early hatched, declined in production from July to September, after which it averaged about 36% for over four months. In February and March, it increased in production and held at over 60% for a period of 13 weeks.

Flocks 3 and 2 had a record of very low production behind them at the beginning of the spring laying season. For the period September 1 to February 1, Flock 2 had averaged a total of 32.4 eggs per hen and Flock 3 had averaged 28 eggs per hen. This contrasts with 57.6 eggs per hen for Flock 6 and 57 eggs per hen for Flock 4. It is needless to say that these differences in production, especially at a season when eggs are high in price, reflect no small difference in gross returns per hen.

During the period of this study, the Boston quotations of top-grade, fresh hennery eggs averaged 47.4 cents per dozen. In the twenty-five weeks when the market was above this average, Farm 6 produced 55.5% of its yearly total eggs, while Farm 2 produced 35.1%.

The actual weekly production of eggs on the group of 23 farms, if plotted, would show a curve slightly different from the per cent production curve in Figure 8. It would not fall as low during the fall nor rise quite as high in the spring, due to the fact that per cent production figures merely show relationship between number of eggs and number of birds and do not indicate the actual amount of eggs laid. With the same per cent production, the larger number of birds in the fall produce more eggs than the depleted flock in spring and summer. August, September and October seem to be the low months in numbers of eggs produced. March and April are the peak months. August, September and October are the months of low total production, and fresh egg price quotations are high; February, March and April are the months of high total production and prices are low.

In Figure 11, the disposition of the eggs is shown by four-week periods. Since eight of the farms sold a considerable number of hatching eggs or chicks, the average supply of eggs going to the market was actually low in January, February and March. In February, over half

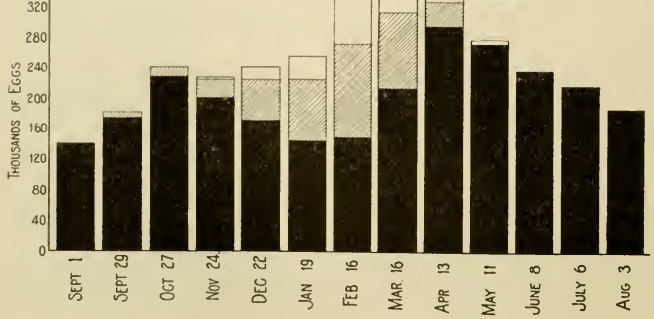

Figure 11—Disposal of eggs by 4-week periods on 23 farms.

of the eggs produced were used or sold for hatching purposes, and in December and March, over one-third. Since these farms handled more eggs for hatching than was required for reproducing their own stock, the solid portion of the chart illustrates one of the problems facing certain commercial growers in supplying a regular market. Since they do supply large quantities at a time when eggs are short, they have so far been able to fit into the marketing scheme very nicely. There is, however, the problem of getting a market back after surrendering it to others for a portion of the year. On one farm approximately 98% of the eggs in February were used or sold for hatching. Only a few dozen eggs went to market that month, compared with 22 cases weekly in October.

On these farms as a whole, approximately 30,800 more chicks were hatched than were brooded so that it might be said that in general the solid, the shaded and about 20% of the white area in Figure 11 would illustrate the marketing of eggs if hatching were confined to individual requirements. Or, estimating another way, the 98,032 chicks brooded on these farms would require about 11,670 dozen eggs a year for hatching based on a 70% hatch, and these would be taken from the amount produced during the months of January, February and March. This would roughly absorb 15% of the eggs produced during that season.

The local egg market is affected by holding eggs for hatching, and thus is influenced by the expansion or decline of the broiler industry. In the mid-west, eggs are withheld for hatching largely in April and May when supplies are very large, which helps to smooth out the production curve of eggs of that region.

EGG SIZE

The income from the laying flock depends not only on the number of eggs produced but also on their quality and their size. Different strains of birds vary greatly in their production capacity and also in the size of eggs. In many instances where breeders have attempted to develop strains of high producing ability, the size of eggs has been ignored. At the present time, however, more and more importance is being placed on this factor.

Egg Size Distribution by Age of Pullets

Then, too, there is a progressive change in egg-size distribution as pullets grow. In the first few weeks of production there is a very large proportion of "pullet eggs," while six months later practically all the eggs may be above 24 ounces.

Weekly egg-size distributions were obtained on 22 Red flocks of known ages. To secure this data, a pen or group of birds on each farm was selected; on a given farm the birds were of uniform age. From the production of each of these groups, a sample of 100 eggs was secured weekly. Ordinarily, this sample represented the eggs gathered on the day of the field man's visit. Each egg was weighed individually, and its weight recorded by checking in ounce classes. Thus, for each pen of known age, a percentage distribution of eggs into ounce classes was made. Then the change of distribution of size of eggs could be compared week by week.

The average distribution of egg sizes is shown at four different ages in Figure 12. The curve at the left illustrates the distribution at 24 weeks of age. It will be noted that a greater part of the eggs produced fell below the 20-ounce line and that only a few eggs were over 24 ounces. At thirty weeks of age, the entire curve of distribution has moved to the right about 2½ ounces. At forty weeks, the curve is practically the same in shape and range but is to the right of the thirty-week curve by about 2 ounces; and again the fifty-week curve is quite similar except that it is still further to the right. The highest point of the curve of the 24-week old pullets was 20 ounces; of the 30-week old pullets, 21 and 22 ounces; of the 40-week pullets, 24 ounces; and of the 50-week pullets, 26 ounces.

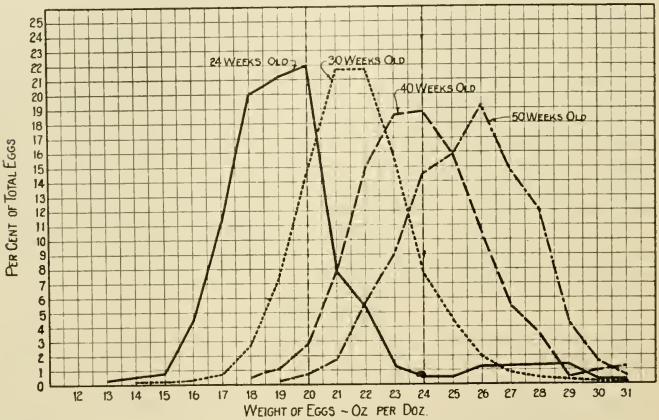

Figure 12—Average egg size distribution of 22 Rhode Island Red pullet flocks at four different ages.

This distribution of eggs by ages has an important bearing on grades. In order to study the effect of size of eggs on gross returns, the distribution for each week was separated into three weight classes: (1) 24 ounces or over, (2) 20 ounces up to 24 ounces, and (3) under 20 ounces. This classification is a little stricter than the state grades, but seems the most practical division.

Distribution of Eggs into Grades by Age of Pullets

In Red flocks, as shown in Figure 13, the number of eggs under 20 ounces dropped quickly from 80% at 22 weeks of age to about 10% at 30 weeks of age. The proportion of large eggs (over 24 ounces) increased from 5% at 22 weeks of age to approximately 80% at 50 weeks of age, after which there was no significant change in weight. At 29 weeks of age, less than 15% of the eggs were over 24 ounces, and less than 15% were under 20 ounces. In other words, at this age the aver-

age Red flock was producing mainly medium-sized eggs. From 50 weeks on, 80% of the eggs were 24 ounces and over; 20% were 20 to 23 ounces, and practically none were under 20 ounces.

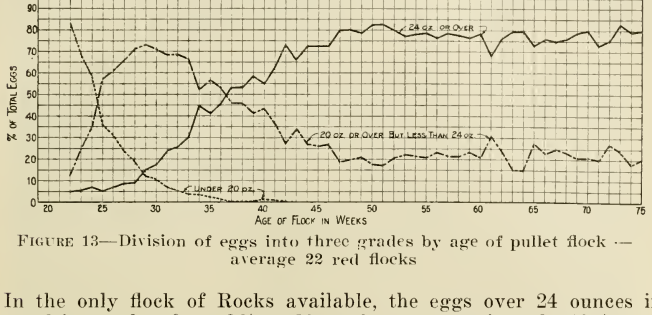

Figure 13—Division of eggs into three grades by age of pullet flock — average 22 red flocks

In the only flock of Rocks available, the eggs over 24 ounces increased in number from 2% at 30 weeks to approximately 60% at 45 weeks. In three flocks of White Leghorns, the per cent of eggs over 24 ounces changed from 5% at 24 weeks to 60% at 35 weeks and to approximately 80% at 50 weeks. Since the number of Rock and Leghorn flocks was limited, the data may not be representative and no intent is made here to compare the breeds.

Effect of Dates of Hatch on Distribution of Eggs in Grades

The proportion of large eggs at different months was estimated for six different dates of hatch. It was assumed that the average egg-size distribution of the 22 Red flocks at each age was representative of the strains in New Hampshire, and also that it was the same for all dates of hatch for each age. The January-hatched pullets would thus have 42% large eggs in September, 58% in October, 66% in November and 80% in December. On the other extreme, June-hatched pullets would begin to lay in December, but would have 42% large eggs in February, 58% in March and would not be up to 80% until May. Of course, if each pen were kept housed for a year, the June-hatched pullets would be laying large eggs in the fall of the next year. April-hatched pullets would be laying 42% large eggs in December, 58% in February, 66% in March and 80% in April.

For very early hatched pullets, provision can be made to lay on range from July to October. They can then be housed from November to the next November when the new crop of pullets would require the house. Thus, without adding to the housing capacity, the birds are kept for about 16 months after beginning to lay. The mixture of pullets' and old hens' eggs would influence the size of eggs marketed from July to October, according to the proportion of older birds and the production of each group. In the fall months when egg prices are high, a few poultrymen are, thus, able not only to expand their laying population but also to secure more large eggs.

Difference in Egg Size Between Flocks

There was a marked difference in flocks in egg-size distribution. The three flocks that were first to reach a point where 75% of the eggs weighed 24 ounces or more to the dozen were selected as "high" flocks. The three that failed to reach this point during the year's production period were considered as "low" flocks. As shown in Figure 14, the

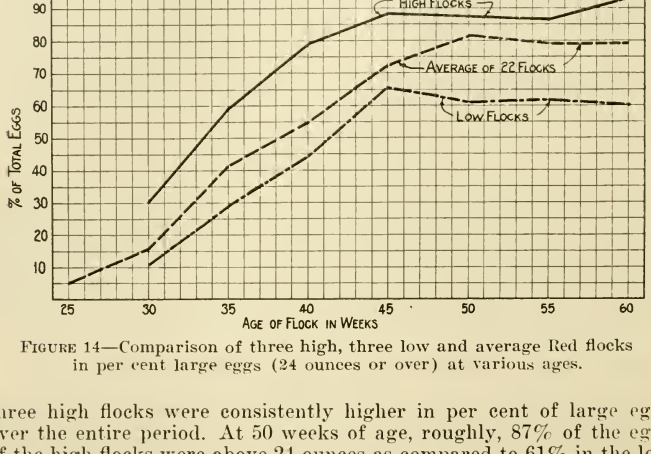

Figure 14—Comparison of three high, three low and average Red flocks in per cent large eggs (24 ounces or over) at various ages.

three high flocks were consistently higher in per cent of large eggs over the entire period. At 50 weeks of age, roughly, 87% of the eggs of the high flocks were above 24 ounces as compared to 61% in the low flocks. The average weight of one dozen eggs from mature birds was 26 ounces in the high and 24.13 ounces in the low. Both groups reached the point of maximum egg size at approximately 45 weeks.

The question arises as to whether or not production was enough greater on these low egg-size flocks to offset the disadvantage in egg size. The three large egg flocks produced 148.9 eggs per bird and the small egg flocks 150.4 eggs per bird—a difference too small to be significant.

THE PROBLEM OF DATE OF HATCH

The problem of best date of hatch involves expected egg production at different dates, sizes of eggs at different dates, price of various grades at different dates, and cost of raising pullets at different dates of hatch.

The price received by the farms in this study varied greatly on account of different markets; some sold at wholesale at the door, others shipped to Boston and still others marketed all or part of their eggs at retail. The market quotations of the Boston Globe for the period have accordingly been used as data for the price problem involved in date of

hatch. Prices for the medium and small grades were not always available and in many instances were estimated. (Figure 15.) The medium

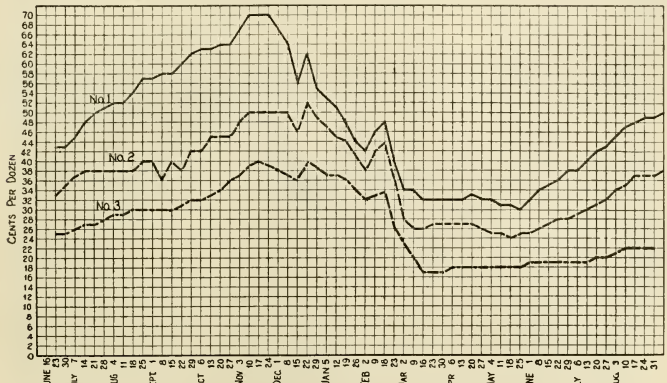

FIGURE 15—Price curves for three grades of eggs from June, 1929, to September, 1930, based on Boston near-by hennery, brown, quotations. (Due to incomplete market quotations, the curves for the Numbers 2 and 3 grades were in part estimated.)

grade eggs run approximately 20% below the top grade in price, and the small eggs approximately 40% below the top.

It is a well known fact that birds hatched at different dates tend to follow different curves in their production. These differences are particularly marked in the case of very early hatched birds as compared with late hatched. Unfortunately, we were able to secure separate production figures on birds of definite hatches from only nine lots of birds. (In most cases, each lot represented a pen.) Comparison is complicated by the fact that the birds were in different flocks, of different strains and under different management and conditions. Accurate determination of the differences in production curves could only be obtained through a large number of records. However, from the limited data available typical production curves are plotted in Figure 16* for: (1) December and January-hatched birds; (2) March birds; (3) May hatched birds.

1. Production Curve on Early Hatched Birds (December and January)

In general, very early hatched birds produce heavily during July, August and September of the first laying years, and usually go into a partial molt the latter part of September or in October. Production is low during the period October 1 to February 1. These birds, after their

* The curves of production for the different dates of hatch as plotted are the average weekly per cent production curves smoothed by hand.

rest period, produce heavily during February, March and the spring months. Peak production will be reached about March 9. It is interesting to note that spring production on these early birds is only slightly lower than that of May hatched birds.

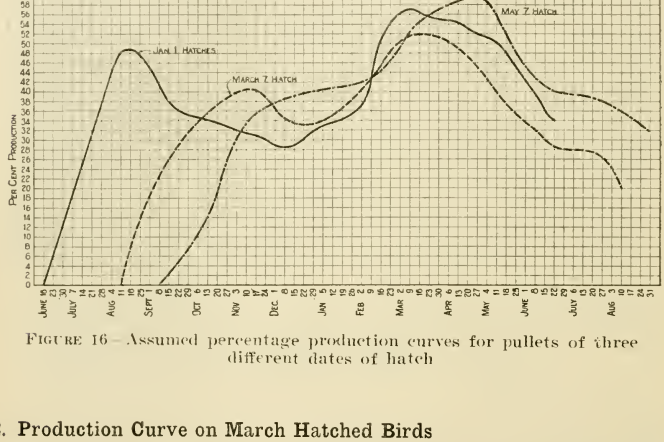

Figure 16—Assumed percentage production curves for pullets of three different dates of hatch

2. Production Curve on March Hatched Birds

March birds, representing a medium date hatch, do not reach as high a peak in early production as do the earlier birds, but the slump due to molt is not as great nor of as long duration. Peak production is reached about the middle of March,—about two weeks later than is the case with the earlier birds.

3. Production Curve on May Hatched Birds

Production on May birds shows a gradual increase until the peak is reached about the middle of April. While it does not reach a very high point until March, the increase is gradual and is not interrupted by any molting period. The spring peak in the case of late hatched birds comes about six or seven weeks later than that of early or medium birds.

These figures are subject to great modification through certain management methods and systems. A few poultrymen are able to carry March hatched birds through without a molt. It is also true that May birds, through mismangement, sometimes go through a molt. However, it is thought that the production curves are fairly typical and represent the tendency, at least, of the curves of production of birds of these hatching periods.

The Effect of Date of Hatch on Value of Total Yearly Output

Applying the production curves and the egg-size figures* to the price quotations, the comparative market-egg value of the yearly product for the three hatching dates is shown in Table 17. In arriving at these estimates, mortality and culling were assumed to take place at the same rate for all three groups, leaving the same number of birds at the end of the 52nd week of laying. The estimates were worked out on the basis of 1000 birds housed in the fall.

Table 17—*Date of hatch and value of annual product of 1,000 birds assuming average mortality and culling rate, and per cent production curves as in Figure 19*

Date of hatch	Total production	Total value eggs	Value per dozen
	doz.		cents
Early (Jan. 1)	8,432	$3687.46	43.73
Medium (Mar. 7)	7,968	3361.82	42.19
Late (May 7)	8,111	3196.27	39.41

The gross income from early hatched pullets was thus found to be 43.7 cents per dozen; from medium hatched, 42.2 cents per dozen, and from late hatched 39.4 cents per dozen.† In production the early hatched birds have an advantage of over 4 cents per dozen, or approximately 50 cents per hen, over late hatched pullets. While it may require more skill to handle the early hatched pullets, the limited data available indicate that early hatched birds produce a greater gross value than do late hatched pullets. There are no data available to indicate any significant difference in cost of producing the pullets at different dates.

Evening Up Production

The poultryman, in his decision as to the time of hatching chickens, must, of course, consider the probable production curves of these birds. If he desires heavy spring production for hatching egg purposes, he may do well to hatch rather late—in April or May. If, on the other hand, market eggs are the sole interest, early hatching should be considered.

In many cases, it is very desirable that production be evened up, particularly where a steady supply of market eggs is required. The poultryman may then wish to spread his hatching dates over a considerable

* The average distribution of eggs into grades as shown for 22 flocks in Figure 13 was assumed as the expected distribution for any given age regardless of date of hatch.

† In comparing gross income from the year's production of pullets of different dates of hatch from the limited data available, emphasis is to be placed on the gross returns per dozen eggs rather than total gross value. Comparison on the latter basis involves differences in total dozens produced, while comparisons per dozen is more a comparison of the shape of the production curve, ignoring to a large extent differences in total production.

period, including some early as well as some late birds. Good production during July, August and September, which are usually low months, can be secured by having early hatched birds.

Efficiency in Use of Equipment

Economy and efficiency in the use of equipment and brooding facilities demand in many cases the raising of two or more lots of chickens, especially where any considerable number of birds are brooded. For instance, the man requiring 2000 chicks might have half of them hatched during January or February, and the remainder during April or May. The early chicks could be put on range by the time the brooding equipment was required for the later ones. In this manner a considerable number of chicks may be raised with limited equipment.

In some cases the very early hatched pullets have been carried on range during the first three or four months of their production period. Whether this can be done by all poultrymen without disturbing the production curve as assumed for birds of that date of hatch is a question. But for the men who are able to do it, the flock can be carried as layers for 16 months with housing capacity for 12 months, and the doubling up would come at a season of relatively high prices,—July, August, September and October.

The determination of proper date of hatch is largely a problem for the individual poultryman. Differences in markets, skill and experience, and in equipment and buildings will bring men to different conclusions.

COST OF PRODUCING EGGS

Eggs a Joint Product

The feed, labor and other expenses entering into the poultry enterprise result in eggs, fowl, broilers, etc.; thus, eggs are a joint product with poultry meat. While it may be possible to assign certain costs to the whole enterprise, the separation of the cost of producing eggs involves much arbitrary allocation. Whenever the joint products or by-products are unimportant and have little value, a rough separation can be made by crediting the value of the minor product to the cost of the major product. But whenever the joint products are equal or nearly equal in value, the costs of any one product cannot be satisfactorily separated from the costs of the other. Estimates on the cost of producing eggs, therefore, must of necessity be subject to wide fluctuations, depending on changes in price of poultry meat as well as in cost of grain.

A Formula

In a rough way, as an average of the farms studied, 17 lbs. of feed, 0.6 hours of labor, 4¢ of supplies and 13.7¢ in overhead, produced 0.4 pounds broiler, 0.7 pounds fowl, 0.3 day-old chick and one dozen eggs. And since the price of broilers, fowl and feed fluctuate greatly in value, perhaps this is as useful a method of studying cost of producing eggs as any other. By substituting the market prices of fowl, broilers and feed, the poultryman may have a guide as to how he is likely to come out under assumed conditions. Since these are average figures, the in-

dividual poultryman should make adjustments in the formula to more nearly fit his special case. Some operators would have larger and others smaller inputs per dozen eggs.

However, if this formula is to be used for outlook work, it is well to note that some of the costs enumerated above may not materially change whether the operator keeps hens or not. The 13.7¢ for overhead is based on interest on estimated investment, depreciation, insurance, etc., and these items would continue even if the hens were all sold.

Use of Formula in Outlook Work

To illustrate how the cost formula may be used, we may assume approximate prices in the spring of 1932:

$$\left.\begin{array}{r}30¢ \text{ grain}\\ 18¢ \text{ labor}\\ 4¢ \text{ supplies}\\ 13.7¢ \text{ overhead}\end{array}\right\} = \left\{\begin{array}{l}8¢ \text{ broilers}\\ 14¢ \text{ fowl}\\ 5¢ \text{ chicks}\\ 1 \text{ dozen eggs}\end{array}\right.$$

or

$$1 \text{ dozen eggs} = 65.7 - 27 = 38.7¢$$

It would appear under the assumption of the formula that the poultryman must average 38.7¢ for his eggs if he is to receive wages of 30¢ an hour for his time, 5% return on estimated investment and an allowance for depreciation. However, if he decided from a review of the outlook that the price of eggs for the year would average lower than 38.7¢, he might still decide to keep on because some return on capital invested and some return on labor are better than no return. If eggs averaged only 25¢ per dozen, he would be able to get some return above the cost of feed and supplies. It will be noted that a five-cent decrease in value of broilers and fowl per pound raises the estimated cost of producing eggs by approximately five cents per doz. Such a formula may have some value in showing the relationship between cost factors, credits for by-products, and cost of eggs and enable the individual to have a better measure of his position relative to other years.

Since these costs are based on assumptions of rate of wages, return on estimated investment, etc., and since the value of these is somewhat dependent upon the value of eggs, the definite figure on cost of producing eggs has little value in itself and should be used only for relative comparison with other years or as a means of roughly comparing efficiency on individual farms.

Relative Comparison of Cost of Producing Eggs

Although eggs are a joint product with fowl and broilers, in order to study some of the management problems in more detail, the cost of producing eggs was estimated for each of the 23 farms. For this purpose many of the cost items had to be allocated arbitrarily and the inventory of pullets at the beginning of the year was given a definite value. Since the same methods of allocation and same assumptions were made in the case of each farm, the results should roughly indicate the comparative costs. The costs are based on the following assumptions:—

1. Value of pullets at housing time was assumed at $2.00—

approximately the market price at the time. (It should be noted that this market price is dependent somewhat on the outlook for egg prices during the winter and also on the market for fowl.)

2. Owner's labor was valued at 40¢ per hour on all farms. Other labor was charged at actual cost.
3. Overhead was estimated by allocating insurance, taxes, interest, etc., on the estimated investment between hens, pullet-rearing and other enterprises.
4. Costs were based on production for market eggs only and such extra costs as B. W. D. testing, certification, the keeping of breeding cockerels and cock birds, were not included.

On this basis the relative importance of the different cost items is shown in Figure 17.

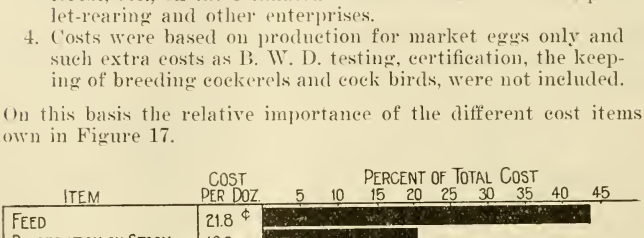

Figure 17—Cost of producing market eggs — average 23 farms.

Feed per dozen eggs averaged 8.3 lbs., or 21.8 cents per dozen.* This was approximately 43% of the cost.

*FEED COST

The amount of feed consumed by the laying flock was estimated by subtracting the estimated amount consumed by cockerels in the laying pen from the total feed supplied to birds in laying pens. It was assumed for this purpose that the amount consumed by pullets and cockerels was the same. The production of the 276,786.6 dozen eggs required the consumption of 2,305,717 pounds of feed, divided as follows:—

	Total pounds	Pounds per dozen eggs	Total cost	Cost per dozen eggs
Mash	947,333	3.423	$29,625.40	$.107
Scratch	1,355,962	4.899	29,356.30	.106
Cod liver oil	2,422	.009	328.80	.001
Carting and sacks....	.....	....	168.71	.0006
Total feed	2,305,717	8.33	$59,479.21	$.215

Depreciation in stock was 10.3 cents per dozen eggs, or 20.6% of the total cost.† This is due to losses from mortality of birds as well as shrinkage in value per bird when fowl are sold. This expense is dependent to some extent on the inventory value of birds at housing time.

Approximately one quarter hour of man labor was used per dozen eggs; this is approximately 10 cents per dozen, or 20% of the total cost.

Use of buildings was 3.3 cents per dozen, or 7% of total cost.

It is evident from a study of the bar chart that feed, depreciation in stock, labor and use of buildings constitute about 90% of the total costs.

The relative costs on each of the individual farms are shown in Table 18 on the basis of cost per hen and in Table 19 on the basis of cost per dozen eggs. In each table the farms are arranged in the order of the total cost per dozen eggs. The comparison of the cost items on these individual farms may be facilitated by studying both tables and noting in detail the situation on a few of the farms. The reader if interested can himself carry the comparisons to a study of all the farms.

The first farm, marked A, produced eggs for 42.2¢ per dozen. On this farm, the feed cost, the depreciation on hens and use of buildings and the total cost per hen were above the weighted average, while the labor cost was below the average. But on account of the very high production of 49.7%, all these costs are below the average when based on per dozen eggs. This farm, which would rank fourteenth on the list if on the basis of cost per hen, was first in low cost per dozen. It will be noted that its consumption per bird was 98 lbs. as compared to the weighted average of 101 lbs., but that its feed cost was $2.91 per cwt. as compared to the weighted average of $2.62.

The second farm, B, produced eggs for 44.1 cents per dozen. In this case the feed consumption per hen is 2 lbs. below A, but with less expensive feed per cwt. the cost of feed per hen was 22 cents below that of farm A. Depreciation on hens, building costs and labor costs were low. With a production of 36.9%, or about 3% below the average, the feed cost per dozen eggs was above average, but other costs were below average.

†DEPRECIATION ON STOCK

Depreciation on stock was determined by subtracting the value of fowl sold, eaten on the farm or on hand at end of year from the inventory value at the beginning of the year.

	Number	Value
Old hens September 1, 1929	10,882	$15,376.65
Pullets housed during fall	27,748	55,478.00
Total birds	38,630	$70,854.65
Sale fowl	18,717	$25,227.07
Fowl eaten on farm	646	683.16
Inventory 1930 (1929 birds remaining)	14,318	16,431.10
Depreciation	.....	28,513.32

Table 18—*Annual costs per bird on 23 laying flocks*

Farm	Feed per hen lbs.	Ration cost per 100	Total labor per hen hrs.	Cost feed per hen	Depreciation on stock	Labor	Use of bldgs.	Other costs	Total costs
A	98.0	$2.91	2.7	$2.85	$1.42	$.91	$.53	$.68	$6.39
B	96.5	2.73	2.4	2.63	.88	.84	.15	.44	4.94
C	98.6	2.41	2.1	2.38	.93	.82	.41	.30	4.84
D	84.9	2.70	3.5	2.29	1.69	1.40	.33	.39	6.10
E	104.3	3.07	2.7	3.20	.99	1.04	.16	.19	5.58
F	108.9	2.33	3.1	2.54	1.32	1.15	.31	.32	5.64
G	119.8	2.40	3.5	2.87	.94	1.34	.37	.48	6.00
H	108.3	2.39	3.6	2.59	1.28	1.20	.20	.64	5.91
I	102.7	2.63	3.5	2.70	1.24	1.19	.30	.67	6.10
J	97.5	2.63	3.7	2.56	.87	1.46	.45	.87	6.21
K	116.8	2.79	2.5	3.26	.79	.90	.66	.59	6.20
L	95.0	2.48	7.1	2.36	.96	2.59	.44	.53	6.88
M	106.9	2.59	2.4	2.77	1.35	.95	.21	.61	5.89
N	100.5	2.63	3.5	2.64	1.17	1.34	.36	.39	5.90
O	97.4	2.33	3.5	2.27	1.36	1.38	.24	.53	5.78
P	97.6	2.58	2.8	2.52	.99	1.12	.31	.77	5.71
Q	95.4	2.67	2.4	2.55	1.95	.94	.47	.57	6.48
R	81.7	2.58	3.3	2.11	1.60	1.30	.70	1.11	6.82
S	115.2	2.47	4.1	2.84	1.63	1.26	.44	.54	6.71
T	100.7	2.76	3.5	2.78	1.19	1.41	.50	.87	6.75
U	105.9	2.56	4.4	2.71	1.43	1.76	.48	1.18	7.56
V	104.6	2.32	5.8	2.43	1.48	2.30	.61	.72	7.54
W	91.5	2.81	4.8	2.57	.79	1.39	.45	.88	6.08
Weighted Average	100.8	$2.62	3.3	$2.64	$1.25	$1.21	$.40	$.56	$6.06

The third farm, C, had a cost of 44.3 cents per dozen eggs; 98.6 lbs. of feed, costing $2.41 per cwt., were consumed per hen. Feed costs per hen were $2.38, or 47 cents below Farm A. Depreciation per bird was 49 cents below Farm A. Total costs per hen were lower than for any other flock. Production of eggs was only 35.9%, and on this account the cost per dozen eggs was higher than Farms A or B.

At the other extreme Farm W produced eggs for 68.9 cents per dozen. Feed cost per hen and depreciation were below the average, but other costs were above. The total cost per bird was about the same as the average, but on account of the very low production of 30.9%, the cost per dozen was the highest in the group of farms.

Farm V had a cost of 61.5 cents per dozen eggs. In this case the feed consumption was 4 lbs. above the average; but as the price of feed used was only $2.32 per cwt., the cost of feed per bird was $2.43, or 20 cents below the average. All the other costs were very high. The total cost per hen of $7.54 was the highest in the group, and even with the good production of 40.9% the cost per dozen eggs was very high.

This brief analysis of the low cost per dozen on the first three farms and the high cost on the last two farms indicates that not one but several factors are important in securing low cost production.

TABLE 19—*Annual costs per dozen eggs on 23 farms*

Farms	Per cent average production	Feed per 1 dozen	Labor per 1 dozen	Feed costs	Depreciation on stock	Labor	Use of buildings	Other costs	Total costs
	%	lbs.	hrs.	cts.	cts.	cts.	cts.	cts.	cts.
A	49.7	6.48	.18	18.8	9.4	6.0	3.5	4.5	42.2
B	36.9	8.60	.22	23.5	7.9	7.5	1.3	3.9	44.1
C	35.9	9.03	.19	21.8	8.5	7.5	3.8	2.7	44.3
D	43.0	6.49	.27	17.5	13.0	10.7	2.5	3.0	46.7
E	39.0	8.79	.22	24.5	8.3	8.7	1.3	4.3	47.1
F	38.4	9.32	.27	21.7	11.3	9.8	2.7	2.7	48.2
G	40.6	9.70	.29	23.3	7.6	10.9	3.0	3.8	48.6
H	39.9	8.92	.29	21.3	10.6	9.9	1.6	5.4	48.8
I	40.6	8.32	.28	21.9	10.1	9.6	2.4	5.4	49.4
J	40.5	7.91	.30	20.8	7.8	11.8	3.6	7.2	51.2
K	40.0	9.61	.21	26.8	7.0	7.4	4.6	5.7	51.5
L	43.9	7.11	.53	17.7	7.4	19.4	3.3	3.8	51.6
M	36.4	9.65	.21	25.0	12.2	8.6	1.6	5.7	53.1
N	34.8	9.25	.33	24.3	10.7	12.3	3.4	3.6	54.3
O	34.9	9.18	.33	21.4	12.8	13.0	2.0	5.2	54.4
P	33.9	9.46	.27	24.4	9.7	10.8	3.0	7.6	55.5
Q	39.3	7.98	.20	21.3	18.8	7.8	3.7	5.1	56.7
R	39.0	6.89	.28	17.8	13.4	11.0	7.5	7.8	57.5
S	38.0	9.98	.36	24.6	14.1	10.9	3.8	4.7	58.1
T	37.8	8.74	.30	24.1	10.6	12.3	4.4	7.5	58.9
U	41.0	8.50	.35	21.8	11.5	14.2	4.5	8.7	60.7
V	40.9	8.41	.46	19.5	12.8	18.5	4.9	5.8	61.5
W	30.9	9.73	.51	27.3	12.6	14.8	4.6	9.6	68.9
Weighted average	39.7	8.33	.28	21.8	10.3	10.0	3.3	4.7	50.1

Feed Cost

Variations in feed cost per dozen eggs are due to: (1) differences in production, (2) differences in feed consumption per hen and (3) differences in price of ration.

For instance, Farm D had a low charge of 17.5 cents per dozen eggs. On this farm, the feed consumption per hen was very low—84.9 lbs.; and the ration was about average in price per cwt. Thus, the feed cost per hen was low, being $2.29 as compared to the weighted average of $2.64. Only two farms had lower feed costs per hen. Since the production of this flock was very high—43%—the feed cost per dozen eggs was very low.

In contrast to this, on Farm W, the low consumption of a high priced ration resulted in approximately an average cost per hen. But on account of low production. the feed cost per dozen eggs was excessive.

Farm V, with good production, low ration cost and high feed consumption per bird, has a feed cost of 19.5 cents per dozen eggs.

Farm K, with good production, high ration cost and high feed consumption, has a feed cost of 26.8 cents per dozen.

Farm P, with poor production, fairly low feed consumption and average ration cost, has a feed cost of 24.4 cents per dozen.

There seems to be no particular relationship between cost of ration per cwt. and production, or between yearly consumption and pro-

duction. It is true that Farm A fed a certain high priced ration and got 49.7% production, but it is equally true that Farm W fed the same ration and got only 30.9%. Also, it should be noted that Farm L, which had the second highest production, 43.9%, fed a low priced ration. On the twelve farms with below $2.62 per cwt. ration cost, the production averaged (simple average) 38.6% at a feed cost of 21.7¢ per dozen. On the farms which fed a ration costing more than $2.62, the production averaged 39.3% at a feed cost of 22.8¢ per dozen.

This comparison brings up an important problem involving technical as well as economic phases of poultry feeding. Laying rations based on the New England College Conference Formula are available throughout the state at a small margin above the cost of the ingredients when purchased separately and have proven very satisfactory to many individual poultrymen. The formula has been used in the official egg-laying contest at Storrs, Connecticut, where record production has been attained. Since the conference formula has proven adequate in securing and maintaining high production, it is suggested here that the New Hampshire poultrymen should use the market price of the ingredients of the conference mixture as a base in comparing ration costs. In other words, it is not essential or necessary to feed the college conference formula, but the operator can at all times compare the price of the commercial feed he is using with the cost of the college conference mixture and thus guard against paying too much for feed.

No doubt, the individual poultryman is constantly laboring under the fear of doing something that will throw his laying flock out of production. This fear is well grounded because mistakes in feeding or management may affect production and bring heavy financial losses. But individual poultrymen in this study in January, 1930, were paying as much as $12 more per ton above the cost of rations based on the conference formula. On a farm averaging 1000 layers this extra cost of mash would amount to approximately $250 a year on the laying flock alone.

In considering laying rations, it is important to realize that production is influenced by methods of feeding, quantities fed, proportion of mash to scratch, adequate supply of clean water at all times, warmth, light, ventilation and health of stock, and details of handling the flocks. Failure in any one of these factors may throw the hens out of production.

Labor

The labor cost is dependent to a large extent on the number of layers per worker. Any contemplated organization, however, of a poultry farm must take into account the strength, health and capacity of the operator. It is thought from observation on this group of farms that an average man in the prime of life can handle 1000 to 1500 laying birds and rear the pullets for replacement with very little hired labor. The poultryman who expects a good income will probably have to plan on at least 1200 birds for a one-man farm and 2500 for a two-man farm.

Depreciation of Stock (Including Mortality Losses)

Assuming a value for pullets at housing time based on the market for good healthy pullets ready to lay, there is a considerable loss during the year from mortality and in shrinkage to a merely meat value when they are culled from the flock.

This loss or depreciation when based on per dozen eggs is influenced by the time of culling and the time of the mortality losses. If heavy mortality or heavy culling occurs early in the season, there are fewer dozens of eggs and a smaller average number of hens to absorb the loss. Hence, the depreciation charge per dozen eggs would be higher. As estimated in Tables 18 and 19, the losses from depreciation averaged $1.25 per bird and 10 cents per dozen eggs. Farm K, with lowest depreciation cost per dozen eggs, had low mortality, culled regularly and sold fowl mostly at retail prices.

Use of Buildings

The estimated cost for use of buildings averaged 40 cents per bird and 3.3 cents per dozen eggs. The high costs on some of the farms result from operating at low capacity due to mortality and severe culling as well as to use of new or expensive buildings. The very low costs of Farms B, E, D, H and M were due to the use of moderate-value buildings held at near capacity. Farm A used expensive buildings, but on account of holding the flock at almost full capacity and securing high production, its building cost per dozen eggs was about average.

The data in Tables 18 and 19 indicate wide variations in each item of cost, and a careful study suggests that a poultryman may secure a combination of good production and low costs in all the items. Sufficient number of layers to keep the men employed to the best advantage, layers housed to capacity in low cost buildings, and fed on good but low cost rations is a combination which should bring success.

Old Hens for Market Eggs

The question of keeping over old hens for market-egg production involves a comparison with pullets as to costs and income.

The practice of retaining the best of the flock for the second year means that ordinarily about 80% as many pullets must be raised to replace the flock, as when only pullets are kept. Since the costs of housing, labor and feed, seem to be approximately the same for old hens as for pullets, the difference in annual cost of keeping birds is mainly a difference in depreciation in value. Actually on most farms this is a question of the cost of raising pullets as compared to the sale value of old hens for meat. For instance, if old hens will sell for $1.25 each and if pullets can be conveniently raised in view of other possible options for time and equipment for $1.50, the difference in cost of keeping old hens or pullets will be this difference in depreciation of 25 cents per bird. That is, with the same rate of mortality the old hens would show 25 cents less depreciation between inventory at the beginning and sales of fowl during the year.

It would seem from a study of cost of pullet production, page 55, that on most farms, pullets can be raised for approximately the sale value of fowl and under these conditions there would be no difference in depreciation, and the cost of keeping hens and pullets for a year would be the same.

In comparing the income from old hens and pullets, it will be well to note differences in seasonal and total egg production and in egg size. A comparison of the egg production curves for old hens in Figure 8 and for pullets in Figure 16 illustrates the differences in seasonal and total production. The old hens not only produce fewer eggs, but in addition the low production comes in the fall when eggs are high. On the other hand, about 82% of old hens' eggs would sell as firsts, while eggs from pullets would grade out as shown in Figure 13. The yearly production of 1000 old hens, assuming the same mortality and culling rate as for pullets, would be 6609 dozen eggs, valued at $2756.81 as compared to a production of 7968 dozen eggs, valued at $3361.82 for March-hatched pullets.

In other words, due to low production in high price egg season, 1000 old hens would return $605 less than March-hatched pullets. According to the differences in costs and income under conditions obtained in 1929 and 1930, old hens inventoried at 60¢ below the value of pullets would give returns equal to those of pullets. To apply the situation to current conditions, the annual product from old hens is worth 82% as much as the product from pullets. This difference in gross returns of 18% can be taken to roughly represent the difference in value of old hens and pullets as layers. Thus, if eggs average 30 cents per dozen for the year the product per pullet housed would be about $2.39 and 18% of this would be 40 cents. Old hens would be worth 40¢ less than pullets in the fall. The New Hampshire practice of keeping mostly pullets seems to be sound.

COST OF PRODUCING HATCHING EGGS

In addition to market eggs, 16 of the farms also produced a considerable number of hatching eggs. On a few of these 16 farms only enough hatching eggs were produced for replacement of laying flock. At the other extreme were those selling large numbers of hatching eggs and using a great many for the requirements of a baby chick business. The sixteen farms produced (for their own use or sale) a total of 52,699 dozen hatching eggs.

On all of the farms a figure representing the relative cost of producing market eggs has been worked out. As previously mentioned, these "market egg" costs did not include such charges as B. W. D. testing, certification, or any charge for use of cockerels. To determine the cost of producing hatching eggs we have merely added these extra costs to the "market egg" figure. It must be admitted that certain of the charges included under market egg costs quite probably would not have existed but for the fact that hatching eggs were being produced. The ofttimes large amount of labor involved in certain breeding systems, the extra care in management, and in a few cases extra feed all represent more or less unmeasureable costs which were absorbed in the cost of market eggs.

The additional costs averaged 11.1 cents per dozen for eggs actually used for hatching. Of this amount 2.8¢ was for testing and certification, 3.7¢ for depreciation on cockerels and 4.6¢ for cost of feed for cockerels. The total cost of producing hatching eggs averaged 60.2 cents per dozen.

The additional costs in producing hatching eggs varied from 4.1 to 39.2 cents per dozen. The total cost of producing hatching eggs ranged from 46.4 to 88.6 cents per dozen.

These costs were estimated on the basis of number of eggs actually used or sold for hatching, and the great variation can largely be accounted for by the presence or absence of some source of disposal of the surplus hatching eggs produced. On a given flock of birds tested, and mated up for the production of hatching eggs, the total extra cost will not be materially changed whether all of the eggs produced go as hatching eggs or whether only a small percentage are so used.

Evidently some of the men who had incurred the extra expense were not able to find an outlet for their surplus and had to dispose of them as market eggs.

TABLE 20—*Relation of number of hatching eggs produced per mated hen to cost of producing hatching eggs*

Number of hatching eggs per mated bird	Number of farms	Average number of mated birds	Hatching eggs produced		Extra costs per dozen hatching eggs	Market egg costs per dozen	Total cost producing hatching eggs per dozen
			Total	Per mated hen			
					cents	cents	cents
Less than 2 dozen	4	1222	1105	.9	23.7	49.2	72.9
2 to 3 dozen	5	1215	3142	2.6	13.1	49.1	62.2
3 to 4 dozen	4	688	2547	3.7	16.2	54.5	70.7
Over 4 dozen	3	1458	7459	5.1	4.8	46.1	50.9
All farms	16	1130	3294	2.9	11.1	49.1	60.2

In Table 20 the 16 farms are sorted according to dozens of hatching eggs used or sold per mated hen. The extra costs of production in the four classes—23.7¢, 13.1¢, 16.2¢ and 4.8¢—indicate the importance of this factor.

The average price recived for all hatching eggs sold by these farms during the period December, 1929, to June, 1930, was 69.7 cents per dozen. The average price for top-grade market eggs during this same period was about 40¢ per dozen. Obviously, those farms which were able to produce hatching eggs at an extra cost of less than 10 cents over market-egg costs were receiving a considerable margin from this phase of their business.

Production of Hatching Eggs for Replacement

The practical question of whether or not to produce their own hatching eggs is raised by many poultrymen. From a breeding pen averaging 40% production during January, February and March, approximately three dozen eggs per hen could be expected, or roughly,

enough to obtain 10 pullets. This means that the breeding flock would require about 10% of the capacity of the house. According to the data in Table 20, the extra costs on the production of three dozen hatching eggs per hen would be approximately 15 cents per dozen. Of course, this would mean the spreading out of the brooding season over several months which might not fit into the best use of available time on many farms.

As far as costs of producing hatching eggs are concerned, it would seem fairly practical for a man to raise his own stock. There are other important considerations, however, such as available time and skill for incubation, and available time for brooding small lots.

The poultryman has three options in obtaining chicks for replacement. He may purchase day-old chicks from a breeder; he may produce hatching eggs and have them custom-hatched; or he may produce hatching eggs and incubate them. The choice of these options should be made by the individual in the light of his own situation and peculiar skills, as well as prices of purchased chicks.

A laying house on one of the co-operating farms. Lower pens are used for individual pedigree matings

INCUBATION RECORDS AND COSTS

Cost of Incubation

The twelve farms which did some incubating hatched 181,423 chicks. One operator hatched 2500 chicks for the replacement of the flock, but the others hatched to supply orders in addition to their own replacements. (Table 21.) One farm, specializing in baby chicks and in custom hatching, incubated over 60,000 chicks.

The average per cent hatch was 67.8%, and the range in hatchability on the individual farms was from 46.9% to 83.0%.

Table 21—*Incubation records on 12 farms*

Farm No.	Number eggs set	Chicks hatched	Per cent hatch
10	19,962	10,034	50.3
13	3,990	2,499	62.6
9	13,577	8,751	64.4
17	9,120	4,279	46.9
18	30,803	19,766	64.2
22	23,968	15,221	63.5
6	8,320	4,636	55.7
20	8,400	5,661	67.4
16	7,944	5,262	66.2
12	19,197	13,720	71.5
4	37,036	30,740	83.0
11	85,096	60,854	71.5
Total all farms	267,413	181,423	67.8

The average cost of incubation was $1.86 per 100 chicks, or $1.26 per 100 eggs set. (Table 22.) The range in cost on individual farms was from $1.05 to as high as $5.23 per 100 chicks. It is to be remembered that this cost is based on an assumed rate of 40 cents per hour for time used in incubation and does not include wages of management.

Table 22—*Average cost of incubating 267,413 eggs, and obtaining 181,423 chicks on 12 farms*

	Total	Per 100 eggs set	Per 100 chicks hatched
Interest on buildings	$156.75	$.059	$.086
Depreciation on buildings	313.50	.117	.173
Interest on equipment	419.44	.157	.231
Depreciation on equipment	838.89	.314	.462
Fuel cost	416.39	.156	.230
Labor (2798 hours)	1052.37	.393	.580
Share of taxes	92.02	.034	.051
Share of insurance	60.88	.023	.034
Miscellaneous costs	23.60	.009	.013
Total	$3373.84	$1.262	$1.860

Cost of Producing Day-Old Chicks

Using the estimated cost figures for production of hatching eggs and adding the estimated incubation costs above, the following figures are obtained as the cost of producing day-old chicks:

Number hatching eggs required for 100 chicks — 147.5

Cost of hatching eggs	$7.37
Cost of incubation	1.86
Total cost — 100 chicks	$9.23

GROWING PULLETS

The twenty-three farms started a total of 93,035 chicks for replacement of the laying flock and housed 35,728 pullets or 38.4% (Table 23).

Table 23—*Summary of brooding records on 23 farms, showing disposal of chicks started*

	Total for 23 flocks	Per cent of chicks started
	Number	%
Broilers sold	32,836	35.3
Roasters sold	1,853	2.0
Pullets and broiler cockerels sold	1,303	1.4
Started chicks sold	2,229	2.4
Used in home	180	.2
Inventoried as broilers, culls	2,585	2.8
Pullets obtained	35,728	38.4
Breed cockerels obtained	2,816	3.0
Dead	13,505	14.5
Total started	93,035	100

Three per cent were saved as breeding cockerels, and 35% were sold as broilers. The total mortality, including all chicks unaccounted for, was 13,505 birds, or 14.5%. The range in mortality for individual farms was from 3.3% to 40.9%. In addition to production of replacement pullets, three farms produced 4997 special winter broilers. The mortality on these was 589 birds, or 11.8%.

When the farms are grouped according to number of chicks brooded in Table 24, the difference in losses in mortality are not enough to be significant except in the group having 3000 to 4000 chicks. This group contained two farms where the losses were exceptionally heavy. In general there is no evidence that those who brood large numbers of chicks have higher losses than others.

Table 24—*Relation of number of chicks brooded to mortality*

Classification number chicks started	Number of farms	Number started		Number died		Per cent mortality	Range in mortality per cent
		Total for group	Average for group	Total	Average		
1000 - 2000	3	4760	1586.7	569	189.7	11.9	3.3 - 22.6
2001 - 3000	5	12697	2539.4	1497	299.4	11.8	6.8 - 22.0
3001 - 4000	4	13774	3443.5	3186	796.5	23.1	10.5 - 40.7
4001 - 5000	5	21500	4300.0	2775	555.0	12.9	7.9 - 28.2
5001 & over	6	40304	6717.3	5478	913.0	13.6	6.8 - 20.4
All Farms	23	93035	4045.0	13505	587.2	14.5	3.3 - 40.7

February, March and April appear to be the favorite months for hatching, and 79% of the chicks brooded came in these three months (Table 25). Only 9% were brooded after April 30th.

Table 25—*Dates of hatch of 1930 chicks for replacement of laying flocks on 23 farms*

Month	Number of chicks	Per cent of total hatched
December	2465	2.6
January	8609	9.3
February	20978	22.6
March	23032	24.8
April	29447	31.6
May	7479	8.0
June	1025	1.1
Total	93035	100%

Detail Records on Cost of Growing Pullets on 18 Farms

In the case of 18 heavy breed flocks more detailed records were secured as to the feed, labor, and other costs entering into pullet production. Of the 63,331 chicks started, 26,762, or 42.3%, were saved as pullets or breeding cockerels. As indicated in Table 26, 35% were sold as broilers, 2.4% as roasters, 3.4% as started pullets, 3.5% were held for sale as cull pullets or broilers and 12.4% had died or were unaccounted for.

Table 26—*Summary of brooding records on 18 flocks of heavy breeds, showing disposal of chicks started*

	Total 18 flocks	Per cent of chicks started
Number chicks died	7,868	12.4
Number broilers sold	22,241	35.1
Number roasters sold	1,493	2.4
Number pullets and breed stock sold	417	.7
Number started chicks sold	2,175	3.4
Number used in home	160	.2
Number inventoried as broilers, culls	2,215	3.5
Number of pullets remaining	24,678	39.0
Number breed cockerels saved	2,084	3.3
Total	63,331	100%

On each farm there were usually several lots of different aged pullets which were not kept separate when on range, and it was impossible to cut off the cost items at a definite age of pullet. However, the records included the cost items on pullets until they were removed from the range and housed. Usually, the operator housed his pullets as they approached maturity; groups would be removed from the range at intervals, in general following the order of the hatching dates of the different lots. But under these conditions some of the lots of pullets were removed at an earlier age than others. Since a definite cut off could not be made, the age of the pullets as removed from the range should be noted when considering costs. The average age of pullet when leav-

ing range was 21.8 weeks. Over 70% were between 19 and 27 weeks of age.

On this group of farms, an average of 237 day-old chicks was started for every 100 pullets housed. However, in addition, broilers, cull pullets and other stock were sold or held for sale, roughly equivalent to 210 lbs. of broilers per 100 pullets housed. Thus, in this group of 18 flocks the 100 pullets and 210 lbs. of broilers are joint products and result from the same expenditure of labor, feed and other cost items. In other words, an expenditure of 237 chicks, 3596 lbs. feed, 85 hours labor, $18.83 for overhead and $10.67 for supplies produced 100 good pullets and 210 lbs. of broilers.

For the period of this study, viz., the spring of 1930, the situation was approximately as follows when the cost items are estimated in money values:

$$\left.\begin{array}{l}\$47.40 \text{ estimated value of chicks}\\ 100.94 \text{ feed}\\ 31.00 \text{ labor}\\ 18.83 \text{ overhead}\\ 10.67 \text{ supplies}\end{array}\right\} = \left\{\begin{array}{c}\\ \\ 100 \text{ pullets}\\ \text{and}\\ 210 \text{ lbs. broilers}\end{array}\right.$$

or

$208.84 = 100 pullets and 210 lbs. broilers

It is obvious that if the sale value of the broilers is credited to the cost of growing the pullets, the market value of the broilers may have considerable influence on the result. Losses or gains on broilers are thus absorbed by the pullets. Under the conditions obtaining on these farms the sale of broilers, etc., amounted to $77.61, and when this is credited to the total cost, the cost of producing 100 pullets can be estimated at $131.15. In noting this cost, it should be remembered that the figure is based on the following assumptions:

1. Chicks valued at 20¢ (market value at that time).
2. Feed at actual cost.
3. Labor at cost for hired labor and assumed rate of 40¢ per hour for owner's labor.
4. Overhead based on depreciation on buildings and equipment, interest on estimated investment in buildings and range, and share of other overhead expense.

Use of Formula in Outlook Work

The formula given above for the cost of producing 100 pullets, if used roughly, should have some value to poultrymen and extension men in comparing one year with another, and by substituting prevailing prices each year should provide some guide as to a poultryman's relative position in different years. Without such a formula, when feed and broilers fluctuate widely in price, it is difficult for the poultryman to interpret his position.

In the spring of 1932, for instance, with feed and broiler prices low, the formula would indicate that pullets cost nearly as much as in 1930 when broilers and feed were higher. Thus, substituting 1932 values in the formula:

$35.50 chicks 70.00 feed 30.00 labor 18.00 overhead 10.00 supplies	=	100 pullets and $37.80
100 pullets	=	$125.70

Detail Cost for Heavy Breeds

The cost items are considered in more detail in Table 27, where they are estimated on the basis of 100 pullets housed and the value of broilers or cull pullets credited. The few breeding cockerels raised were included in these estimates as "pullets."

Table 27—*Average cost of producing 100 pullets on 18 farms (heavy breeds) to an average age of 21.8 weeks*

	Cost	Value of credits	Per cent of total cost
Feed			
Mash (2238.2 lbs.)	$70.61		
Scratch (1317.4 lbs.)	29.01		
Grit (19.1 lbs.)	.20		
Oats (9.8 lbs.)	.23		
Dried milk (3.9 lbs.)	.27		
Semi-solid buttermilk (2.1 lbs.)	.09		
Cod liver oil (1.4 lbs.)	.27		
Miscellaneous (3.8 lbs.)	.26		
Total feed (3595.7 lbs.)	$100.94		48.3
Litter	2.49		1.2
Coal	6.32		3.0
Interest on equipment	1.20		.6
Interest on buildings	2.59		1.2
Depreciation on equipment	2.41		1.1
Depreciation on buildings	5.17		2.5
Interest on land	2.22		1.1
Share of taxes	2.22		1.1
Share of insurance	.94		.5
Interest on investment in stock	2.08		1.0
Miscellaneous costs and supplies	1.86		.9
Labor 85 hours	31.00		14.8
237 chicks (estimated at 20c per chick)	47.40		22.7
Total gross costs	$208.84		100%
Credits per 100 Birds Remaining			
Broilers sold (83.1 birds)		$58.82	
Roasters sold (5.6 birds)		6.80	
Pullets and breeding cockerels sold (1.6 birds)		2.18	
Started chicks sold (8.1 birds)		2.16	
Number used on table (.6 birds)		.47	
Broilers and culls inventoried (8.3 birds)		7.18	
Total credits (107.3 birds)		$77.61	
Net cost	$131.23		

The total gross cost per 100 birds housed was $208.84. Feed, day-old chicks, and labor are the largest items of cost and together make up 86% of the total. The cost of chicks was estimated at 20¢ each,—an arbitrary assumption where men produced their own chicks.

For every 100 pullets saved, 107 birds were sold from the flock as broilers, cull pullets, roasters, etc. As shown in Table 28, about 76% of those sold were taken out at an age between 10 and 15 weeks. Over 12% were sold before 10 weeks of age. This age at which the excess cockerels and cull pullets are sold has a bearing on the cost of producing pullets inasmuch as the amount of feed consumed will be larger if the broilers are held longer.

Table 28—*Average age at which broilers, roasters, etc., were sold from 18 flocks heavy breeds (culls and broilers inventoried at time of cut-off regarded as sold at age when inventoried).*

Age in weeks	Number sold	Per cent of chicks started	Per cent of total number sold
1	260	.4	.9
2	920	1.5	3.2
3	655	1.0	2.3
4	300	.5	1.0
5	20	...	.1
6	20	...	.1
7	.....	...	....
8	.....	...	....
9	1330	2.1	4.6
10	3568	5.6	12.4
11	7726	12.2	26.9
12	4597	7.3	16.0
13	2461	3.8	8.6
14	1048	1.7	3.7
15	2425	3.8	8.4
16	1022	1.6	3.6
17	427	.7	1.4
18	174	.3	.6
19	131	.2	.5
20	1049	1.7	3.7
21	293	.5	1.0
22	118	.2	.4
23	15	....	.1
24	.....	....	....
25	30	....	.1
26	12	....	....
27	.....	....	....
28	100	.2	.3
Total	28701	45.3	100

The credits from sale of the 107 birds amounted to $77.61; the estimated net cost per 100 pullets at an average age of 21.8 weeks was $131.23. (Table 27.)

Since the age at which pullets were removed from range to houses varied on individual farms, accurate comparisons of costs between individual farms were not attempted.

Detail Cost for Leghorns

In addition, costs on three flocks of Leghorn pullets were obtained. Of the 16,881 chicks started, 41% were saved as pullets, 2.5% were saved as breeding cockerels, 42% were sold as broilers or culls, and 14.8% died or were unaccounted for. The average age at housing time was 17.9 weeks as compared to 21.8 weeks for the heavy breeds. On account of this difference in age at housing time, the data may not be used in comparing breeds. However, a study of Table 29 indicates that the gross costs per 100 pullets are lower and that credits from broilers are considerably lower.

Table 29—*Average cost of producing 100 Leghorn pullets on 3 farms to an average age of 17.9 weeks*

Item	Cost	Value of credits	Per cent of total cost
Total Debits per 100 Birds Remaining			
Feed	$68.99		40.6
Litter	.86		.5
Fuel	4.34		2.6
Interest on investment in equipment	.95		.6
Interest on investment in buildings	1.94		1.1
Depreciation of equipment	1.90		1.1
Depreciation of buildings	3.57		2.1
Charge use of land — interest	1.51		.9
Share of taxes	1.28		.8
Share of insurance	.92		.5
Interest on investment in stock	2.08		1.2
Labor cost	32.92		19.4
Miscellaneous costs	2.80		1.7
Day-old chicks	45.68		26.9
Total cost	$169.74		100%
Credits per 100 Birds Remaining			
Broilers sold (82.0 birds)		$30.26	
Pullets and breeding cockerels sold (12.0 birds)		13.53	
Started chicks (.7 birds)		.13	
Total receipts (94.7 birds)		$43.92	
Net cost	$125.82		

Further Studies Needed

A general study such as this opens up many problems that can be adequately solved only by further more detailed investigations. For instance, in dealing with the problems of different dates of hatch of laying flock, technical studies are needed in management of flocks of early hatched pullets to determine best practices in avoiding molt and in maintaining steady production. Also, production records are needed on a large number of pens of pullets in order to have more accurate data for comparing different dates of hatch.

Data are needed on weekly consumption of feed and weekly gains of chickens from beginning of brooding to 20 weeks of age in order that the poultryman may be able to dispose of the male birds to the best advantage.

Labor efficiency studies are needed to determine in detail the most efficient methods for each operation as guides to those who are now unable to handle large numbers of layers. From this material there should be projected types and sizes of poultry organizations for one-man and two-man units.

SUMMARY

1. Detailed records for the period, September, 1929, to September, 1930, were secured by regular visits to 23 specialized commercial poultry farms in southern New Hampshire. These flocks averaged as follows: 995 layers; $13,424 investment; $2070 farm income; and $1399 labor income.

2. Great variations in the amount of chore labor were found. The range was from 1.1 to 5.8 hours per laying hen. The high labor requirements on certain farms were due to poor arrangement of buildings, poor watering equipment, unsystematic organization, small size of flock and uneconomic practices.

3. Feed consumption averaged 8.7 lbs. per dozen eggs. Of the 104 lbs. of feed consumed by the average layer in a year, 40.5% was mash.

4. Mortality and culling were found to reduce the size of the flock to such an extent that the average population of layers was only 77% of the maximum housed in the fall. Mortality averaged 16.9%, with a range of 5.6 to 35.9%. Depreciation and mortality losses on layers amounted to 10 cents per dozen eggs.

5. Pullets exceeded old hens in production, averaging 150 eggs per bird as compared with 112. Average production of all flocks was 145 eggs per layer, or 39.7%.

6. Eggs were found to increase gradually in size from the beginning of laying at about 24 weeks of age to a maximum size at 50 weeks of age; but certain flocks showed a small-egg tendency during the whole period, and others a large-egg tendency. There was no evidence of relationship between egg size and production.

7. When price of eggs, egg size and production are considered, early hatched pullets gave a higher return than late hatched; and pullets gave better gross returns than old hens.

8. As a rough statement of the cost of producing eggs, the following formula was developed:

17 lbs. feed 0.6 hours labor 4¢ supplies 13.7¢ overhead	produce	0.4 lbs. broiler 0.7 lbs. fowl 0.3 day old chick 1 dozen eggs

A similar formula was developed for the cost of producing 100 pullets.

9. Hatching eggs were found to cost an average of 11.1 cents more per dozen than market eggs. The range was 4.1 to 39 cents, depending largely on the number of hatching eggs used per mated hen. The average per cent hatch was 67.8, and the range in hatchability from 46.9 to 83%. Incubation cost averaged $1.86, and day-old chick cost $9.23 per 100 chicks. The mortality on chicks reared for pullet replacement was 14.5%.

10. It is believed that a young man, given proper organization of business and efficient equipment, can handle from 1000 to 1500 layers and produce the pullet replacements with very little hired labor. A sufficient number of layers to keep the man employed to best advantage, layers housed to capacity in low-cost buildings, fed on good but low-cost rations, is a combination which should bring success.